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Investigation into the labour factors affecting project performance within the Egyptian construction industry

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Investigation Into the labour factors affecting project performance within the Egyptian Construction Industry

Faculty of Engineering and Computing

By
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May 2015



A thesis submitted in partial fulfillment of the university's requirements
for the degree of Masters by Research

Investigation into the labour factors affecting project performance within the Egyptian Construction Industry

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**Submitted in Partial Fulfilment of the Requirements of the
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Table of Contents

List of Figures.....	iii
List of Tables.....	iv
Acknowledgements	v
Abstract	vi
Chapter 1 Introduction	1
1.1 Introduction.....	1
1.2 Aims/Objectives.....	4
1.3 Contribution of this Research.....	4
1.4 Structure of Thesis.....	5
1.5 Chapter Summary.....	7
Chapter 2 Review of Literature	8
2.1 An Overview of the Construction Industry.....	8
2.2 Labour Productivity in Construction Projects.....	9
2.2.1 Definition of Productivity	10
2.2.2 Definition of labour productivity in Construction	11
2.2.3 Importance of Labour Productivity in Construction Projects.....	13
2.3 Factors Affecting Labour Productivity	14
2.3.1 Labour Productivity Factors Analysis.....	15
2.3.2 Risks of Labour Productivity	24
2.3.3 Case Studies in Labour Productivity	25
2.4 Egypt (Construction Industry) Case Study.....	35
2.4.1 Construction Labour in Egypt	36
2.4.2 Construction Market Risk in Egypt	37
2.4.3 Building Companies after the Revolution.....	37
2.4.4 Construction Industry after February 2011 and June 30 Revolution	38
2.4.5 Explanation of Upper Egypt.....	39
2.4.6 Problems with Upper Egypt Workers in Construction	41
2.5 List of factors and their groups that might affect labour productivity in Egypt.....	42
2.6 Summary.....	45

Chapter 3 Research Methodology.....	46
3.1 Introduction.....	46
3.2 Research Process.....	47
3.3 Research Design	50
3.3.1 Research Philosophy.....	50
3.4 Research Data.....	51
3.4.1 Primary Data.....	51
3.4.2Secondary Data	52
3.5 Sampling	56
3.6 Primary Data Analysis.....	58
3.7 Result of Questionnaire.....	59
3.8 Research Ethics.....	61
3.9 Research Limitations	62
3.10 Chapter Summary.....	62
Chapter 4 Results and Data Analysis	63
4.1 Introduction.....	63
4.2 Human/Labour Factor	64
4.3 Material Factors	71
4.4 Management Factors	78
4.5 External Factors.....	83
4.6 Interview Findings and Analysis	89
4.7 Chapter Summary.....	95
5.0 Conclusion and Recommendations.....	96
5.1 Introduction.....	96
5.2 Overview of research aim and objectives	96
5.3 Achievement of the research	97
5.4 Recommended key strategic drivers	98
5.5 Recommendations for Future Work.....	100
6.0 References.....	102
Appendix A English Questionnaire	109
Appendix B Arabic Questionnaire	111
Appendix C Interview questions.....	113

List of Figures

Figure 1- 1 Organisation of Thesis	6
Figure 2- 1 The Factor Model of Labour Productivity developed by H. Randolph Thomas (Thomas et al, 1997).....	13
Figure 2- 2 Egypt Map with all 27 governorates (CIA Library, 2014)	39
Figure 2- 3 Highlighted are 9 governorates that form Upper Egypt (CIA Library, 2014)	40
Figure 3- 1 A copy of diagram showing the narrowing down of the research topic (Naoum, 2007).....	47
Figure 3- 2 Research Process	49
Figure 3- 3 Saunder's Research Onion (Saunder et al, 2009).....	51
Figure 3- 4 Structure of Questionnaire	53
Figure 3- 5 Snapshot of English questionnaire.....	54
Figure 3- 6 Snapshot of Arabic questionnaire	55
Figure 3- 7 Percentages of Respondents for Each Professional	60
Figure 3- 8 Percentage of respondents' experience year in industry	61
Figure 4- 1 Ranking of Human/labour Factors	65
Figure 4- 2 Ranking of Material Factors	71
Figure 4- 3 Ranking of Management Factors	79
Figure 4- 4 Ranking of External Factors	83
Figure 4- 5 Snapshot of Interview questions.....	89
Figure 4- 6 Summary of interviews findings for management factors.....	91
Figure 4- 7 Summary of the challenges that affect labour productivity from interviews point of view	92
Figure 4- 8 Summary of interview findings on how the government may help improve labour productivity	94

List of Tables

Table 2- 1 Summary of how researchers (Soham,2013; Ailabouni et al, 2012; Jarkas, 2012; Mahesh, 2012; Zakeri et al, 2010; Karimi et al, 2010; Enhasi et al, 2007; Alinatiwe et al, 2007; Abdul Kadir et al, 2005; Makulsawatudom et al, 2004; Kaming et al, 1997) grouped the factors affecting labour productivity in different countries.....	23
Table 2- 2 Top ranked factors in South of India and the same factors ranked in the study in Kuwait. (Soham, 2013; Jarkas, 2012)	26
Table 2- 3 Summary of the previous research done of the factors affecting labour productivity in construction projects in each country and how was the research conducted.....	31
Table 2- 4 Construction sector spendings from 2005-2015 in Egypt (source: Yehya, 2012)	35
Table 2- 5 Total construction labourers out of total work force in Egypt (CAMPS, 2013)	36
Table 2- 6 Population and Area of each Upper Egypt Governmate (CAMPS,2013).....	41
Table 2- 7 List of factors and group the researcher thinks might affect labourers productivity in Egyptian Construction Industry.....	44
Table 3- 1 Summary of Research Philosophy	47
Table 3- 2 Number of Respondent and their professions	60
Table 3- 3 Respondents and their years of experience in the industry	61
Table 4- 1 Group Ranking according to Average Relative Importance Index	63
Table 4- 2 Human/Labour Factors ranking that affect labour productivity.....	64
Table 4- 3 Ranking of Material Factors that affect labour productivity	71
Table 4- 4 Management factors ranking that affect labour productivity	78
Table 4- 5 External Factors ranking that affect labour productivity	83
Table 4- 6 Overall Ranking of all factors that affecting labour productivity in Egyptian Construction Projects	88

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Abstract

In today's world, the construction industry is a key player in the economy, of any country and employment rate. After both the 2011 and 2013 revolutions construction projects have been extremely important to Egypt since they increase the employment rate, improve the economy, bring foreign investment, and help in the development of the country. Research has shown that 20% of these construction projects fail to achieve their goal as a result of delays, or cost overruns that can put any construction project at risk. One of the important part of these construction projects are labourers' productivity, since labourers account for 30-50% of the construction budget it is important to study what are the factors that affect labourers' productivity in the Egyptian Construction projects.

Since productivity factors cannot be eliminated, professionals can mitigate their risks on construction labour productivity through conducting proper project studies to manage the relevant affecting factors. This is why the researcher studies the factors affecting construction labour productivity, to identify and rank them, so professionals can consider and manage their effects during the whole life cycle of any construction project.

The research design includes primary data analysis and secondary data analysis from the literature review. In order to gather data, questionnaires and interviews have been undertaken by the researcher. The questionnaire followed the literature review and consisted of 41 factors the researcher believed might affect labour productivity in Egyptian Construction Projects. The interviews were conducted for a better understanding of the issues and possible ways to manage or reduce such factors that affect labour productivity on site. The findings of the questionnaire were analysed with previous research conducted in developed and developing countries. The researcher then recommends possible ways to manage or reduce such factors. He also shows the important role that government and contractors play in improving labour productivity in Egyptian Construction Projects.

Chapter 1 Introduction

1.1 Introduction

There has been a change in the way the construction industry has been working due to the use of advanced tools, technology, management skills, material, and heavy equipment. The industry plays a much more “prominent role in developing countries compared to developed countries” (Altaf, 1979). The importance of the industry can be measured by how much the sector adds to the country’s economy through its contribution to the Gross Domestic Product (GDP) and the portion it takes in any nation’s employment population (Sweis et al, 2009). In many developing countries, major construction projects account for 10% of their Gross Domestic Product (GDP) and approximately 50% of the wealth invested in fixed assets (Abdul Karim et al, 2005). Moreover, the development of the construction industry in developing countries lags far behind other industries in those countries compared to developed countries (Yiman, 2011). The nature of the industry is considered very complex since it involves many stakeholders such as owners, contractors, consultants, regulators, and suppliers (Ghoddousi et al, 2012).

Each construction project is unique and that is due to its nature based on size, budget, material, location, weather conditions, and manpower (Budawara, 2009). However the goal of all construction projects is to build projects on time, within budget, with the stated quality standards, and within a healthy and safety environment. Research has shown that 20% of these construction projects fail to achieve their goal as a result of overscheduling, delays, or cost overruns that can put any construction project at risk (Archibald, 2012; Nasirzadeh et al, 2012; Jarkas, 2012; Omran et al, 2011; Wah Chui et al, 2010; Kalsum et al, 2010; Saunders et al, 2009; Sambasivan et al, 2007; Enhassi et al, 2007; Proverbs et al, 1999; Thomas et al, 1997)

Construction projects risks are generally perceived as events that affect the projects’ cost, time, and quality. The extent to which risks exist in a particular project is linked negatively to the likelihood of a successful outcome to any projects (Hughes, 2006). Some of these risks include labour productivity factors that lead to low productivity, which ultimately leads to project failure. That agrees with (Ugwoeri, 2012) “That low

labour productivity can result in project delays and increases costs”. (Hughes, 2006) states that “failure to properly manage risks often leads to increased cost, schedule, delays, disputes, claims and litigation”. Since productivity has an inverse relation to cost, improving low labour productivity will not just reduce cost, but will also benefit the contractor by increasing profit margins (Ghosh et al, 2004).

Researchers have studied and identified the problems that the construction industry is facing, and some of these studies recommend solutions to these problems. Soekiman et al (2009) has stated that the construction industry has witnessed a decreased rate in labour productivity compared to any other industry. That is due to a number of factors that contractors and project managers have not taken into account namely; payment delay, labour experience/skill, lack of material, rework, lack of incentive schemes, poor site conditions and so on. Due to the fact that profit margins are low on construction projects, cost savings and labour productivity are considered fundamental reasons for becoming a successful contractor. That also agrees with Intergraph (2012) that contractors should consider monitoring labour productivity accurately to be able to estimate and fund the project. Ailabouni et al (2012) states that if labour productivity can be improved “contractors will not only be more efficient and profitable, knowing actual productivity levels also helps them to estimate accurately and be more competitive during bidding for projects”.

Productivity issues can be divided into macro and micro levels. At the macro level, one deals with contracting methods, labour legislation, and labour organisation (Jarkas, 2012). At the micro-level, one deals with management and operation of a project (usually at the site of the project). Labour productivity is one of the most discussed topics in the construction industry since labour cost can account for up to 50% of the budget (Yamany, 2007). It can be measured to identify current and future trends in the industry, as well as to compare performance with previous projects. Several studies and research were done by Soham et al (2013), Ailabouni et al (2012), Jarkas et al (2012), Olasbosipo et al (2011), Karimi et al (2010), Enhassi et al (2007), Zakeri et al (1996), Lim et al (1995) to identify the factors affecting labour productivity in construction projects, but only a few studies were done in developing countries. Therefore, this research aims to identify and

recommend solutions to the factors affecting labour productivity in Egyptian construction projects as a case study for a developing country.

Since the start of the Arab Spring in January 2011, the political and economic outlook has been unstable, causing a rise and fall in the Middle East Construction projects. Despite its instability, the GCC (Gulf Cooperation Council) has quickly gained a prominent place at the top of the construction industries in the region. The Qatar National Bank stated that these megaprojects have made the average GCC construction budget around US\$ 115bn in 2011-2012, to support infrastructure projects to meet the growing population (The Economist, 2013). There have been more than 117 planned programmes to be completed by 2030 across all Middle East countries, adding up to an overall cost of US\$1 trillion. These programmes include major infrastructure, new houses, transportation roads, hospitals, and schools. The UAE is due to lead the race with (US\$329.4bn), followed by Saudi Arabia (US\$255bn), Qatar (US\$156.8bn), Kuwait (US\$130.3bn), Iraq(US\$123.3bn), and Oman(21.8bn) (Albawaba, 2013).

The construction industry in Egypt is a multibillion-dollar industry. It contributes approximately 15%-17% of the GDP (Gross Domestic Product), with an investment expected to reach US\$21bn by 2017 (UKBI, 2013). Being the largest country in the Middle East with the 4th largest economy, the Egyptian construction industry has been facing a range of difficulties since the 2011 revolution. The prices of the construction materials have risen to reach 600EGP per cement ton and 5200EGP per steel ton (El- Behary, 2013). Other difficulties may include rising industrial fuel prices, higher taxes, and the devaluation of the Egyptian pound against the US dollar. Simultaneously, suppliers and contractors are holding prices to avoid profit margin decline (Badawi, 2013).

The lack of secondary education and proper training explains the existence of a large segment of young Egyptian construction labourers (Badawi, 2013). The problems are that many labourers in Egyptian construction projects are either uneducated, untrained, or unqualified. They receive low wages, lack motivation, pay high taxes, and have no medical insurance or life insurance. The aforementioned factors have direct effects on project completion and success, as they cause labourer demotivation and disloyalty to the contractor. Moreover the Egyptian government has stated that there has been a decline in

labour performance on-site, as a result of wasting 50% to 70% of their employment time waiting for material delivery, travelling to site, taking unscheduled breaks, starting work late, and finishing early (Chitkara, 1998). Finding labourers in Egypt is considered a very easy task for contractors/subcontractors. They either have their own team that works for them, or they form a new team by publishing a small advert in any national newspaper. So there is a need to explore/investigate and analyse the factors beyond this decline followed by identifying the key drivers of improving labour productivity

1.2 Aims/Objectives

The aim of this thesis is to identify the factors contributing to the decline in labourers' productivity in the Egyptian Construction Industry, and affect project performance. In addition this thesis aims to propose key strategic drivers that will enhance labourers' productivity in the Egyptian Construction Industry (ECI). The underlying objectives are as follows:

- To critically reflect on productivity challenges to construction labourers
- To demonstrate the current status of the Egyptian Construction Industry
- To identify, rank and analyse factors that impact the labourers productivity in Egyptian Construction Projects
- To recommend key strategic drivers that will enhance labour productivity.

1.3 Contribution of this Research

The researcher believes that the findings of the present research will help change the culture of the Egyptian construction industry by showing how the old system running in the industry causes low productivity. In order for the relationship between contractors and labourers to be improved, the problem has to be addressed clearly. To begin with, the thesis will identify the key deficiencies in labour performance within the construction sector in the Middle East generally, and in Egypt specifically. Moreover, the thesis will address the matter of reducing the unproductive time spent per day, affecting project completion, budget, and quality.

1.4 Structure of Thesis

The thesis is divided into 5 chapters, as illustrated in Figure 1-1. **Chapter 1** contains an introduction, which is intended to give an explanation of the important role the construction industry plays in the country's economy and employment. It also gives an overview of the construction industry in the Middle East and Egypt, followed by the problems facing labourers which can affect cost and project success. The aim/objectives are stated in this chapter, as well as contributions of this research. The chapter also includes structure and organisation of the thesis. **Chapter 2** presents a historical background on the factors affecting labour productivity in the construction industry in different countries. As well as a clear definition of productivity and construction productivity. This chapter also illustrates the Egyptian construction industry and explains the reasons behind the decline in labour productivity in the Egyptian construction projects. Next, the researcher will develop a list of factors that he thinks might affect labour productivity in Egyptian construction projects based on previous research. **Chapter 3** develops a research design, research philosophy, and refers to the methodology that will be used. The chapter will include limitations of research and research ethics. **Chapter 4** presents and analyses the data collected and discusses the results based on existing literature review. The chapter presents a detailed ranking of the factors that affect labour productivity in the Egyptian Construction industry and compare it with similar culture countries. **Chapter 5** gives a conclusion of the whole research, stating the problem and explaining the researcher's findings. It will also illustrate how the aforementioned objectives have been met and how they can contribute to eliminating the problem.

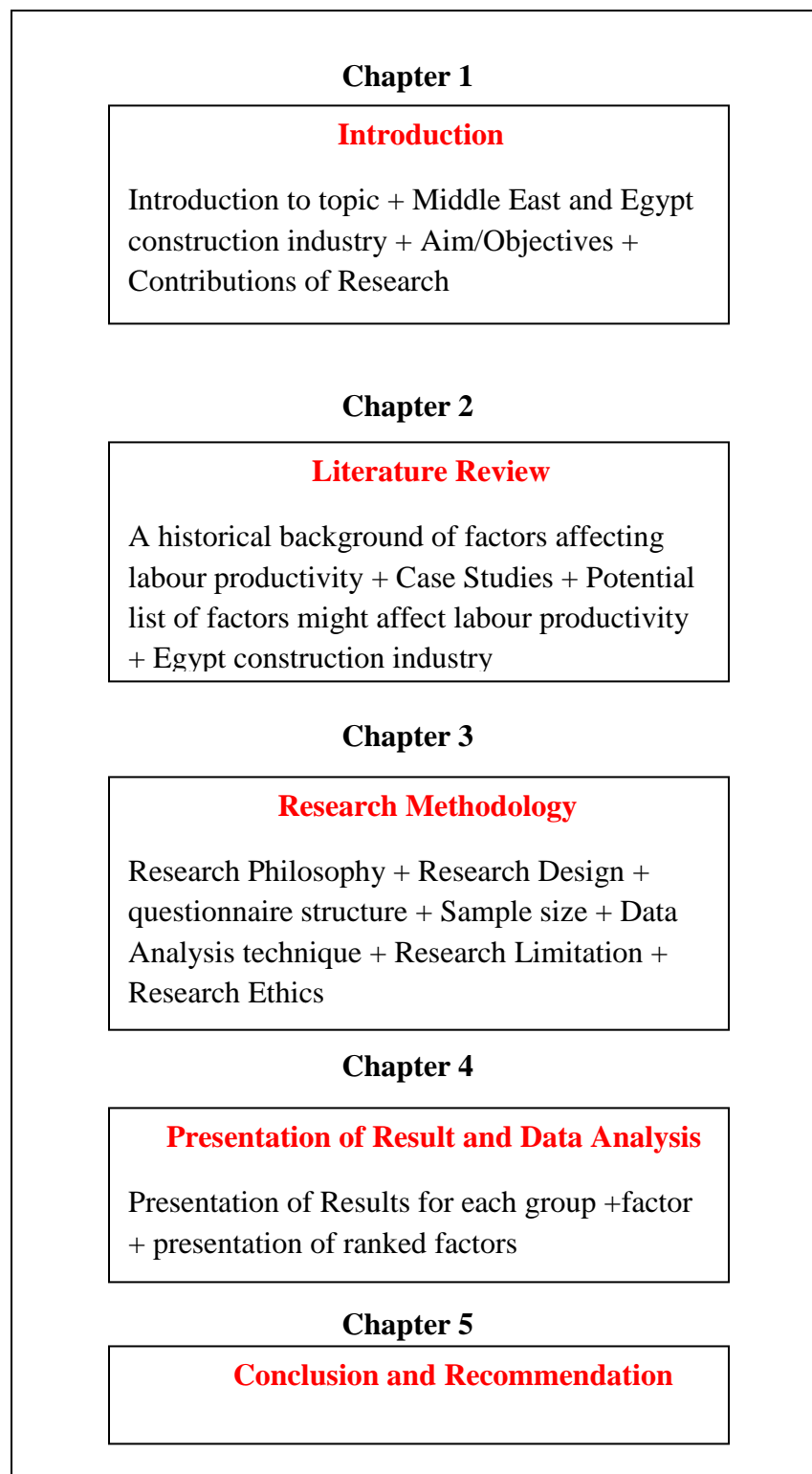


Figure 1- 1 Organisation of Thesis

1.5 Chapter Summary

This chapter introduces the construction industry and its important role in any nation economy and employment rate. It also discusses the difficulties experienced by the labour in the sector, and their impact on productivity. An overview of the Middle East and Egyptian construction industry is presented, specifically the problems with the Egyptian labourers on construction projects. The secondary data will be discussed in depth in the following chapter.

Chapter 2 Review of Literature

2.1 An Overview of the Construction Industry

Every day construction projects are being started to meet the growing needs of the population and to keep up with global development. The construction sector not only has a significant effect on economic and social life, but it also helps in meeting the needs and inspiring the local culture (Enhassi et al, 2007). Research carried out by (Takim, 2002; Kalsum et al, 2010; Enhassi et al, 2011; Archibald, 2012) has shown that 20% of these construction projects fail to achieve their goal. Any construction organisation must have a strategic plan and vision that lead the way to achieving their goals. Every construction project is different and unique. In the past, industry problems stemmed from a lack of resources and technological expertise, but recently it is the management and administration of these problems that have assumed greater prominence. Any project can be improved, however this improvement requires management's knowledge on what to improve and how to improve it (Agung, 2012). Project management must be planned on many levels, starting with implementing, organising, delegating, decision making and finally performing. The industry has become more complex due to new business demands, challenges, large numbers of parties as clients, contractors, consultants, stakeholders, shareholders, regulators, and others. Labourers are a very important part of the construction phase of any project, since they are the ones who are actually responsible for building the project. In developing countries, construction involves more workers per activity on site, typically two to ten times as many workers per activity compared to developed countries (Koehn, 1999).

An important aspect of the development of the construction industry is to ensure that the industry adds to the Gross Domestic Product (GDP) because it gives a whole picture of the country's economy and attracts foreign investors. Additionally opens new doors for construction professionals and labourers. The construction industry has a remarkable impact on the GDP, as it contributes between 7-10% to the GDP of most developing countries (World Bank, 2013). It can be stated that this percentage makes the industry more powerful than in developed countries. The high unemployment rates in developing countries allow contractors to easily replace workers when their performance is not at a satisfactory level. In most projects labour can cost up to 50% of the overall project

budget (Yamany et al, 2007). Despite this fact, it is one of the least studied topics in the construction industry.

2.2 Labour Productivity in Construction Projects

All construction projects rely on the productivity of equipment and workers to achieve good results. Due to its importance, productivity is one of the most frequently discussed topics in the construction industry. As stated previously, labour can cost up to 50% of the overall project budget, and reducing labourers' cost can be achieved by improving labour productivity. In Uganda for example, Alinaitwe et al (2007) has stated that the construction industry contributes over 12% of the Gross Domestic Product and has been growing for the past 20 years. The major problem facing the industry is poor labour productivity, which results in cost and time overruns. That also agrees with Attar et al, (2012) that "poor productivity of labour can cause delay to projects, and additional cost to the overall budget". Delay can be defined as extra time that can lead to financial distress. Delay can also cause customer dissatisfaction, because delays, project failures, and cost overrun can result in the client no longer doing business with this construction company. The aforementioned problem can be eliminated by improving labour productivity (Sambasivan et al, 2007). Njeri ,(1999) has discussed this point in the research she has conducted in Kenya. She stated that "customer satisfaction in the construction industry is measured by the ability of the construction team to deliver the project within the stipulated time, cost and quality". On the contrary Horner et al (1989) stated that a 10% increase in construction labour productivity would yield an annual saving of approximately 1 billion to the British Economy. This agrees with Nasirzadeh et al (2012) who states that "improving construction labour can go some way towards eliminating time and cost overruns". It can also be stated that labour productivity is particularly important especially in developing countries where most of the building work is still carried out on a manual basis. The problem with productivity does not just have a direct effect on project success, cost, delay and customer satisfaction but it also has indirect effect on the workers and the organisation in their motivation and teamwork (Sambasivan et al, 2007). Labour productivity estimates are often performed by individuals using combinations of analytical techniques and personal judgment (Sewis et al, 2009). Hanna et al (2005) has mentioned that of all project resources (materials, equipment, and labour), labour represents the most significant risk to the contractors. The loss of

construction labour productivity can be attributed to various factors, These factors include management factors (eg: planning, incentive programs, and competency of labour supervision), human factors (eg: labour experience, skill age, and education), external factors (training sessions, design changes, payment delays, and government law), resource factors (poor site conditions, material storage location, and violation of safety rules) and miscellaneous factors (accidents during construction, shortages of water and power supply (Horner et al, 1989 ; Lim et al, 1995; Kalsum, 2010; Enhassi et al, 2011; El-Gohary et al, 2012; Harding, 2012; Jarkas, 2012). Understanding how much these factors affect labour productivity is crucial to improving project performance, increasing profit, and overall project success.

2.2.1 Definition of Productivity

There is not only one single definition for productivity. It can be measured and defined in many different ways. The word “productivity” was first mentioned in an article by Quesnay in 1766 (Jarkas, 2012; Soham et al, 2013). The Oxford English dictionary defines productivity as “the power of being productive, efficiency and the rate at which goods are produced”. At the beginning of the twentieth century, a better understanding and definition was given to productivity. The American Association of Cost Engineers (2008) defined productivity as a “relative measure of labour efficiency, either good or bad, when compared to an established base or norm”. More research was done to improve and measure productivity, where many researchers have defined productivity in different ways. (Krugman (1994) defined productivity as the “ratio between the output volume and the volume of inputs”. In other words, it measured how efficiently production inputs such as labour and capital, are being used in an economy to produce a given level of output. Ailabouni et al (2012) defined productivity as “the ratio of output of required quality to the inputs for a specific production situation”. In the United States the construction industry defines productivity as “to measure the effectiveness with which management skills, workers, materials, equipment, tools and working space are employed at, or in support of, work-face activities, to produce a finished building, plant, structure or other fixed facilities at the lowest feasible cost” (Wah Chui et al, 2010).

The Building and Construction Sector Productivity Taskforce (BCSPT, 2009) sees productivity “as an industry’s ability to convert inputs into outputs”. Productivity has been looked at as a way to measure performance of construction labour. This agrees with

Durdyeu et al (2011), who defines productivity as "a measure of how well resources are leveraged to achieve set objectives or desired outputs. This also agrees with the organisation for economic co-operation and development that commonly defines productivity as a ratio of a volume measure of output to a measure of input use. The House of Commons in the United Kingdom defined productivity as how efficiently inputs (labour and capital) are used to produce outputs (goods and services).

More recently; Jarkas (2012), Ailabouni et al (2012), and EL-Gohary (2013), have defined productivity as $\frac{\text{input}}{\text{output}}$. Hughes (2006) defined productivity by the following equation 1:

$$\Psi = \frac{V}{L} \quad (1)$$

Where:

Ψ = average labour productivity

V= value added

L= labour employed

Kazar et al (2008) expressed input and output in terms of money and Linguong et al (2008) defined productivity as “the ratio of the quantity of input to quantity of output”.

2.2.2 Definition of labour productivity in Construction

In construction, productivity can be regarded as a measure of outputs that are obtained by a combination of inputs. As stated previously, the input resources are labour, material, equipment, plant, energy and capital, but they are not limited to only these sources. Dozzi et al (1993) defined labour productivity in construction as “the physical progress achieved per hour”. For example how many cubic metres of concrete were poured per hour. This definition measures the labour dollars required to produce a square metre or square foot of living area, or the labour cost of providing one bed in a hospital.

El-Gohary et al (2013), Soham et al (2013), Nasirzadeh et al (2012), Jarkas (2012), Enhassi et al (2011), Linguong et al (2008) started to look at the output and input in

terms of dollars (money). Total productivity factor (TPF) method was introduced, where all the outputs and inputs are considered. It can be expressed in equation 2:

$$TPF = \frac{\text{Total Output}}{\text{Labour+Material+ Equipment+Energy +Capital}} \quad (2)$$

Dar (2013) expressed that labour productivity in construction can be calculated by using equation 3:

$$\text{Labour Productivity} = \frac{\text{Real GVA}}{\text{Number of Jobs} \times \text{Number of average hours worked}} \quad (3)$$

GVA is the Gross Value Added (It is GDP excluding subsidies and taxes on production). The theory behind this equation is that if GVA increases but the other values remain constant then labour productivity will increase. On the other hand, if the values increase and the GVA remains constant then there will be a decrease in labour productivity Dar, (2013).

It can be concluded from section 2.2.1 and this section, that labour productivity in construction can be measured in different ways. Equations 4 and 5 show the different ways of measuring labour productivity depending on the operation done, time, and cost. The researcher will be using equation 5 as the definition of labour productivity

$$\text{Labour productivity} = \frac{\text{Output}}{\text{Labour cost}} \quad (4)$$

or

$$\text{Labour productivity} = \frac{\text{Output}}{\text{Work hour}} \quad (5)$$

In general, productivity signifies the measurement of how well an individual entity uses its resources to produce outputs from inputs. Figure 2-1 shows a factor model of labour productivity in construction that was created by Randolph Thomas in 1997. The model expresses the input in terms of labour hours that are converted to outputs or quantities of work through the application of some work methods. (Thomas et al, 1997)

argues that factors affect the work method such as supervision, weather, rework, tools, and materials, therefore it affects the output which cause overtime in the schedule.

This image has been removed due to third party copyright. The unabridged version of the thesis can be viewed at the Lanchester Library, Coventry University

Figure 2- 1 The Factor Model of Labour Productivity developed by H. Randolph Thomas (Thomas et al, 1997)

2.2.3 Importance of Labour Productivity in Construction Projects

Labour productivity is one of the most serious factors that affect the physical progress of any construction project (Durdyeu et al, 2011). In order for any construction industry to keep improving project success, it first needs to improve the standard of labour productivity to reduce the cost of any construction project. As stated earlier in this thesis by Horner et al (1989), a “10% increase in labour productivity can save the United Kingdom and the British Economy billions”. The Asian Productivity Organisation has argued that “improvements in labour construction productivity would make a substantial benefit to the national economy (Integraph, 2012). According to Hammad et al (2011) an “increase in labour productivity may result in more growth and a positive effect on the society”. For example, Orascom Construction Industries ,one of the Construction companies in Egypt, is due to finish 5,000 affordable houses by 2015. An increase in

labour productivity may reduce the overall cost of the project, which can result in more affordable houses being built.

Every contractor, subcontractor and employer has to agree to a contract for the project to start. These contracts have a start date, plan, budget, work scope, duration, finish date and other important factors for any project. This agrees with Hammad et al, (2011) that “Every year companies and contractors are hit with billions of dollars in construction claims as a result of lack of labour productivity”. Improving labour productivity in construction projects will, not only result in project success, but will also result in a significant impact on improving the GDP, which effects the economy and reputation of any country.

2.3 Factors Affecting Labour Productivity

Since each project has its own climate, technology, materials, budget, design and so on. Labour productivity in every construction project depends on a number of factors that are affected by various reasons. To achieve the income expected from any construction project and make sure the project is successful, it is important to have good control of the productivity factors that can affect the labour. This agrees with what Soham (2013) has stated in his research paper “critical factors affecting labour productivity in construction project; case of South India”, that solving factors that affect labour productivity can have a direct effect on the project success, and can save time and cost. Identification and study factors affecting labour productivity on construction projects has become a major issue facing both project managers and contractors in increasing labour productivity (Attar et al, 2012). This agrees with Atkinson (1997) that “it requires an understanding of the various indicators of productivity as a path to understanding the performance of the project” to increase labour productivity in construction projects.

In most construction projects, project managers give a great deal of their construction activities to sub-contractors in order to decrease the project costs (Ghoddousi et al, 2012). Working with such a method makes the sub-contractor base earn profit on the volume they perform, so there is no doubt that they put in a constant tireless effort to produce as much as possible. Nowadays things have changed, especially in the Egyptian construction industry. The company supplies materials, tools, electricity and other vital prerequisites for carrying out construction activities. The sub-contractors are then responsible for

supplying human resources and are paid in relation to the volume of the completed work. This method agrees with the conclusion reached by Ailabouni et al (2009) that “sub-contractors are not interested in the factors affecting labour productivity (performance) and improving them” because they think it’s a waste of time and paying attention to such factors doesn’t make a difference to the construction project success.

Although many researchers have studied the factors affecting labour productivity, there are still productivity problems that remain unknown and need to be further investigated in developing countries (Soekiman et al, 2009). Jarkas (2012), has stated that factors in developing countries are different from those in developed countries, and that labour in developing countries can handle more tasks with unfair wages just to keep an income for their families. Olabosipo et al (2011) indicated that “influencing factors are rarely constant and may vary from country to country, from project to project, and even on the same project depending on the circumstances, anything influencing them can subsequently affect productivity”. This disagrees with Durdyeu et al (2011) in a similar research done in New Zealand stating that “Although major productivity factors may vary amongst projects, companies, and geographical areas, some similarities in issues obstructing productivity could be observed. Therefore, lessons learned to overcome productivity challenges at one project may be useful to be applied at another project for productivity improvement”.

2.3.1 Labour Productivity Factors Analysis

Different researchers have divided these factors into different categories. From previous research, a total of 113 factors that affect labour productivity on construction projects were found. Knowledge and understanding of these factors is needed to determine the focus of the necessary steps in an effort to reduce project cost overrun and project completion delay. The classification of these factors in categories is helpful in giving a better understanding and in managing such factors.

Enhassi et al (2007) classified the factors into 10 groups – namely, manpower, leadership, motivation, time, materials/tools, supervision, project, safety, quality, and external factors. Manpower factors include lack of labour experience, labour disloyalty, misunderstandings amongst labour, lack of competition, and labour personal problems. Leadership factors include misunderstandings between labour/superintendents, and lack

of periodic meetings with labour. Motivation includes payment delay, lack of financial motivation systems, lack of places for eating and relaxation, and lack of training sessions. Time includes misuse of time schedule, work overtime, increasing number of labour in order to accelerate work and working 7 days per week without taking any holidays.

Durdyeu et al (2011) states that a research done on site labour productivity in New Zealand classified the factors in two groups: internal factors and external factors. Internal factors are broken into project finance, workforce, technology/process, project characteristics, project management. External factors are statutory compliance, unforeseen events, and other external factors (economic and political).

Research conducted on the UAE's construction industry has shown that the factors affecting employee productivity are divided into 4 different categories: (Ailabouni et al, 2009)

- environmental factors
- group factors
- individual factors
- organisational factors

Environmental factors included labour market characteristics, economic situation, safety and job security, climate and weather conditions, site layout, and political situation. The environmental factors mentioned by Ailabouni et al (2009) were similar to the external factors mentioned by Durdyeu et al (2011). Group factors include group structure or composition, overall skills of the group, culture difference, language barriers, and frequency of changes. Individual factors include motivation and morale, level of academic experience, past training, absenteeism, overall job satisfaction, overall appreciation, past experience and age. Organisational factors include work timing/working hours, construction work complexity, interruption of work, level of communication, and management involvement.

In Kuwait, Jarkas (2012) developed a survey with 45 previously studied factors to find which affected the Kuwaiti construction labour on construction projects. He stated that

100% of the workers on construction projects are foreign. He chose the top 5 factors in each category used in previous research, and classified them into four different groups :

- management
- technological
- human/labour
- external

Management factors include construction method, payment delay, crew size and composition, lack of incentive schemes, lack of labour supervision. Technological factors include clarity of technical specification, restricted site access, and delay in responding to Requests For Information (RFI), and inspection delay by the engineer. The Human/labour category includes motivation of labour, skills of labour, age, physical fatigue, and shortage of experienced labour. External factors include high/low temperatures, high humidity, sandstorms, high winds, and rain. Similar research was conducted by Soham (2013), where he identified and ranked the factors affecting labour productivity in construction projects. He stated that (Jarkas, 2012) has surveyed the most important 45 factors and categorised them in the right way.

On the other hand, Soekiman et al (2009) stated that the performance of labourers is affected by many factors which are usually linked to the performance of time, cost, and quality. He divided these factors into 15 different groups – namely,

- design
- execution plan
- material
- equipment
- labour
- health and Safety
- supervision
- working time

- project factor
- quality
- financial
- leadership and coordination
- organisation
- owner/consultant
- external factors.

In his research, he conducted a survey with the factors related to labour productivity affecting the project schedule performance in Indonesia. His objective was to survey small, medium, and large companies. In the same country, Sugiharto (2003) conducted a survey on factors affecting productivity in construction projects in Indonesia to identify the significant variable of waste. He divided the factors into three different groups – namely,

- characteristics of contractors
- waste management strategy
- organisational focus

Characteristics of contractors include qualification, quality systems of companies, and ownership. Inadequate waste management strategy includes lack of understanding of the concept of waste, lack of tools for identifying and measuring waste, and limited waste documentation records. The Organisation's focus group includes client objectives, project goal, and the involvement of all construction personnel.

In Iran, Ghoddousi et al (2012) carried out a similar research paper to the ones done by Jarkas, 2012 (Kuwait), Enhassi et al, 2007(Gaza), Ailabouni, 2009(UAE), Durdyeu,2012 (Turkmenistan), and Soham,2013 (South India). He conducted a survey with the top ranked factors that affect labour productivity in Iranian construction projects. He categorised the factors into seven different groups – namely,

- materials/tools
- construction method
- management/planning
- supervision
- rework
- weather
- job site condition

Ghoddousi et al (2012) argues that some of these factors have been categorised into a larger group. For example, weather and job site condition can be classified into external factors. He states that each of these factors can have a group on its own since each one of them has many factors that are linked. Materials/tools includes materials that have not arrived on site yet, shortage of materials on the market, lack of proper tools and equipment on site and equipment breakdown due to aging or poor maintenance. Construction method includes operatives who exert considerable physical force to perform the jobs. Management/planning includes no construction planning/project schedule in place, inadequate skilled workers on jobs, management does not support safety planning, and poorly laid out construction jobsite. Supervision factors include stoppage because of inspection delays, inexperienced site managers who cannot handle challenges that arise in the field, incapability of managers to give workers the required training to perform their job properly. Rework include jobs that need to be redone as a result of damage after work completion. Jobs that need to be redone have either not passed the quality control inspections and testing, or have witnessed major changes in design, drawing or specification. Weather factors include unsuitable thermal environments, which are too hot, too cold, or too humid. Jobsite conditions include disruption of power services, disruption of water services, considerable distance from home or camping site to jobsite, and whether the jobsite is too noisy/dusty.

Kazaz et al (2008) designed a questionnaire in his research “effect of basic motivational factors on construction workforce productivity in Turkey”, comprising 54 detailed questions that contained 37 factors that affected productivity in construction projects. The factors were categorised into four groups:

- socio-psychological
- organisational
- economic
- physical

Socio-psychological factors include work discipline, health and safety conditions, work satisfaction, creating competition, cultural differences and giving responsibility. Organisational factors included a firm's reputation, relaxation allowances, site layout, supervision, camping conditions, and material management. Economic factors include on-time payment, union membership, amount of pay, social insurance, and discontinuity of work. Physical factors include working on similar activities, error tolerance, overtime, shifts, weather conditions, and design complexity

Other researchers conducted their survey without categorising the factors. Abdul Kadir et al (2005) listed the top 50 factors that were used by previous research in a survey done on “factors affecting labour productivity for Malaysian residential projects”. Some of the factors that were surveyed were material shortage at the project site, slow response of the consultant's site staff, site congestion, claim certificate, late issuance of progress payment by client to contractor, equipment shortage, poor weather conditions, the use of a construction management contract, and lack of coordination among consultants. Abdul Kadir et al, (2005) targeted 70 contractors, 11 developers and 19 consultants to participate in the study. The respondents were asked to rank the importance of the 50 project related factors to construction labour productivity. The data was then subjected to the calculation of important indices, which then enabled the factors to be ranked.

Zakeri et al (2010) conducted a survey including 13 factors that cause poor productivity in Iranian construction operative's performance. Zakeri et al, (2010) chose the first top three or four factors that were ranked in previous research in the same field. Some of these factors were inspection delay, lack of proper tools and equipment, work, safety, weather and site conditions, and lack of materials. The questionnaire survey was given to 355 construction operatives on 31 sites in Iran, and was divided into six sections

of a total of 49 questions, covering a number of productivity related factors. Olabosipo et al (2011) in Nigeria conducted research on the “factors negatively affecting of construction labours performance”. He chose the top two factors in each category that were used by previous researchers. These factors include external factors, environmental factors, human/labour factors, organisational factors, and management factors. He then conducted a survey that contained 12 factors that included lack of training and retraining, poor communication, inclement weather, unfair wages, late information, out of sequence work, and poor specification. The survey was given to the labourers and to project managers.

Research was carried out in Sri-Lanka by Wijekoon, (2006) on “factors affecting labour productivity in bridge construction projects”. He divided the factors to survey into two parts; A and B, where he only surveyed 20 factors. Part A consisted of 7 factors, and respondents were requested to rate the factors’ influence on the bridge projects. Part B included 13 factors, and respondents were requested to indicate whether the factors adversely influence labour productivity or not by choosing “yes” or “no”.

Part A factors included labour crew performance, availability of skilled labour, project supervision, design details, constructability, accuracy of the estimates, and construction difficulty.

Part B factors included: weather conditions, access to the area, site conditions, site congestion, sequencing or phasing, reassignment of staff or crew, inspection/quality requirement, material supply, improper or insufficient equipments/tools, walkouts or strikes, change orders, and claim situations.

Research undertaken by Makulsawatudom et al (2004) on the “critical factors influencing construction productivity in Thailand” identified 23 factors without placing them into any category. The study was conducted in Thailand between the period of November and December of the year 2000, and mainly targeted project managers working on construction projects. Each participant was asked to rate the factors affecting productivity on a scale from 0 (no influence) to 5 (very much influence). They were also

asked to express their opinion of the potential factors for improvement on a scale from 0 (no potential) to 4 (very high potential). Some of the surveyed factors were lack of material, lack of tools and equipment, poor communication, weather, instruction time, change orders, rework and inspection delay.

In another research conducted by Durdyeu et al (2012) on “factors constraining labour productivity case study of Turkmenistan”, the factors constraining labour productivity of Turkish contractors were further analysed. The questionnaire was designed so that respondents rank the factors from a scale 1-5, 1 being very low and 5 very high. The survey was sent by email to consultants, contractors and subcontractors to complete. The original questionnaire consisted of 28 factors affecting labour productivity. A pilot test was done to confirm questionnaire reliability, and then the researcher had decided to reduce the factors to only 23. Some of these factors were high cost of foreign labour, material storage, working overtime, rework, payment delay, lack of labour motivation, poor estimates and schedule pressure.

Table 2- 1 Summary of how researchers (Soham,2013; Ailabouni et al, 2012; Jarkas, 2012; Mahesh, 2012; Zakeri et al, 2010; Karimi et al, 2010; Enhasi et al, 2007; Alinatiwe et al, 2007; Abdul Kadir et al, 2005; Makulsawatudom et al, 2004; Kaming et al, 1997) grouped the factors affecting labour productivity in different countries.

Group	Factors
Material	Material shortages, tools and equipment shortages, unsuitability of materials location, lack of material, delay in arrival of materials, low quality of raw materials, high quality of required work, inefficiency of equipment, and delays due to interference with other crews
Management	Construction managers lack of leadership, lack of labour supervision, working overtime, crew size and composition, unsuitability of storage location, accidents as a result of poor site safety programme, proportion of work subcontracted, construction method, payment delay, incentive programs, competency of labour supervision, poor scheduling and coordination, inspection delay, misunderstand between labour/superintendents, work overtime, and lack of places for eating and relaxation for labourers.
External	High/low temperature, high humidity, high wind, rain, on site accidents, ground conditions, natural disasters, energy crises/costs, fluctuations in exchange rate, design changes, training sessions, security (crime and theft), access to finance, market inflation, access to utilities (electricity and water), and corruption
Human/Labour	Motivation of labour, skill of labour, physical fatigue, a shortage of experienced labour, level of education, labour age, lack of competition, labour disloyalty, and labour personal problems
Technological	Clarity of technical specification, the extent of variation/change order during execution, coordination level among design disciplines, design complexity level, rework, site layout, and site restricted access.
Organisation Work	Discipline/hierarchy order, delegation, reward schemes, competencies of supervisors/seniors/managers and management involvement and awareness.

Some other researchers used the same factors grouped in table 2-1, but under different titles. For example, Enshassi et al (2011) in Gaza used a group title “Manpower” factors which included lack of labour experience, labour disloyalty, lack of competition, labour absenteeism and labour personal problems. The same factors have been grouped in India, Kuwait, United Arab Emirate (UAE), United States of America (USA), and Turkmenistan under “Human/Labour” factors as seen in table 2-1

2.3.2 Risks of Labour Productivity

The construction industry, like any other industry, faces challenges and complexity that place projects at risk (Redmill, 2002). It is subject to more risks and uncertainty compared to other industries. In recent years, researchers Ugwoeri (2012), Ghosh et al, (2002), Redmill (2002), Shen (1997) identified risk factors that have a direct effect on project completion. Since construction labour productivity is a key role in project success, it has been a major part of recent studies. Ghosh et al (2004) states that his research has shown that labour productivity was ranked high in risk factors for project completion because of the “relation to cost and time required obtaining and applying such resources.

In order to understand the risk factors, they first need to be identified, especially if these risks affect project completion, success, and narrow profit margins (Redmill, 2002). That agrees with Shen (1997) that the “purpose of risk identification is not only to identify a list of risk factors but also to identify the importance of these risk factors”. In another piece of research conducted by Ugwoeri (2012), labour productivity was categorised under the risk factor “Physical”, which was one out of the nine groups Ugwoeri has stated. Ugwoeri’s research has shown that labour productivity was ranked 30 among 44 which he considered as a "Medium Risk Factor". Both researches done by Ugwoeri (2012) and Ghosh et al (2004) have shown that labour productivity is a risk factor that needs to be given more attention to. Identifying the main sources causing such factors can lead to better project performance. That agrees with Redmill (2002) who argues that “The purpose of identifying the source of risk is to prevent the events that can go wrong and that can lead to breaches of safety”.

Managing risks in constructions project has been recognized as a very difficult process. In order to achieve the aims/objectives of any construction project, managing risks has to be a priority. Ugwoeri (2012) states that risk management has two main phases to be dealt with: 1) risk assessment; which includes identification, analysis and prioritization. 2) risk control; which includes risk management planning, risk monitoring planning, risk resolution, track, and corrective action.

2.3.3 Case Studies in Labour Productivity

Case studies were investigated in order to get a deeper understanding of the factors affecting labour productivity in each country, and understand what might be the reasons behind these factors. In Kuwait, the research done by Jarkas (2012) has shown that the top ranked factors affecting labour are; clarity of technical specification, change orders during execution, coordination level among various design disciplines, lack of labour supervision, proportion of work subcontracted, and lack of construction management leadership. The results obtained from this research demonstrate that the technological group was ranked first with 70.69%. External factors were the least ranked group with 54.05%. In Turkmenistan, Durdyeu et al (2012) found that his top 6 factors are lack of local experience labour, schedule pressure caused by government, working overtime, financial weakness of the contractor, rework, and inadequate financial policies of the government. It can be said that the top 6 factors in his research were different than the top ones ranked in Kuwait. For example, rework in Kuwait was ranked 16 amongst 45 factors, while it was ranked 5th amongst 20 factors in the study of Durdyeu's et al (2012). Also lack of experienced labour was ranked 1st in Turkmenistan while only 22nd in Kuwait. Similar research was done in Southern Regions of India by Soham, (2013) in the research "Critical factors affecting labour productivity in construction projects. Misty used the same factors that were chosen by Jarkas (2012) in his research done in Kuwait, but he only chose to survey the top 27 factors affecting labour productivity in Kuwait. The research targeted 152 contractors and received a total of 51 responses, which is 30% of the required sample. The top ranked factors were payment delay, skill of labour, clarity of technical specification, shortages of material, motivation of labour and construction method. Table 2-2 shows a comparison between the top 10 factors obtained from Soham, (2013) (Southern of India) and how they were ranked in the study of Jarkas, (2012).

Factor	Ranked in South of India	Ranked in Kuwait
Payment delay	1	29
Skill of labour	2	20
Clarity of technical specification	3	1
Shortages of material	4	27
Motivation of labour	5	14
Construction method	6	28
Physical fatigue	7	21
Inspection delay/ stringent by the engineer	8	37
A shortage of experienced labour	9	22
Construction managers lack of leadership	10	8

Table 2- 2 Top ranked factors in South of India and the same factors ranked in the study in Kuwait. (Soham, 2013; Jarkas, 2012)

It is clear from table 2-2 that there is a difference in ranking between the same factors in Kuwait and India. The researcher believes that the difference between South India and Kuwait in the ranking of the factors could be due to the financial strength of the contractors in Kuwait. Another reason is due to the high population of experienced and skill foreign labourers that work in Kuwait it is very difficult to have shortage of experienced labour. Other factors such as payment delay are ranked very low due to the government policies that makes sure labourers get paid on time.

In Iran, Zakeri et al, (2010) have shown a different outcome than the one proposed by Jarkas, (2012) (Kuwait) and Durdyeu et al, (2012) (Turkmenistan). Between the 10 factors surveyed, low level of pay was ranked as number 1. Some of the top ranked factors were casual labour force, remote site and family problems, delay in payment, discontinuity of work, and job opportunity.

Combinations of financial and material factors were ranked top factors in the research undertaken in Malaysia by Abdul Kadir (2005). Material shortage at project site was ranked 1st amongst the 50 factors surveyed. It is followed by non-payment (financial problems) to suppliers, causing the stoppage of material delivery to site. They are then followed by change order by consultants causing project delay, late issuance of construction drawing by consultants, incapability of contractor's site management to organise site activities, and late issuance of progress payment by client to contractor.

Kuykendall (2007) has carried out research in the USA on the key factors affecting labour productivity in the construction industry. He has chosen 12 factors, which were then distributed to 200 contractors from the ENR (Engineering News Record) top 400. The survey gives a brief description of each factor and the contractor is asked to assign a weight to each of the factors based on his/her knowledge and past experience in the construction industry. It was found that the top factors were management skills, followed by schedule management, safety management, labour skills, labour motivation, and equipment management. It can be seen that the top factors affecting labour productivity are mainly management factors. In Adamu's et al (2011) research "labour productivity constraints in the Nigerian Construction Industry", Adamu et al (2011) have shown that low wage levels are detrimental to productivity and was ranked first followed by lack of material being instrumental to productivity, instruction delay contributing to low production, and absenteeism of gang members causing delay. These results are different than the ones found by Olabosipo et al (2011) in their research about factors affecting the performance of labour in Nigerian construction sites. Olabosipo et al (2011) showed that the top factors in his research are lack of training and retraining, poor communication, inclement weather, unfair wages, and lack of motivation. The factors that Olabosipo et al (2011) have reached show that training, communication, and motivation are the main human factors that affect labour performance. On the other hand, Adamu et al (2011) showed that lack of material and low wage were the main factors constraining labour productivity in the Nigerian construction industry. Although both of the research took place in Nigeria the results have shown different top ranked factors. This can be due to the fact that each researcher targeted a different sample with his questionnaire, with different factors.

Due to a high number of foreign labourers in UAE and Kuwait, the researcher assumed that all research done would have found an almost similar result. This is due to hot weather, approximately the same salary, same living conditions, same government laws and regulations. The results found in Ailabouni's (2012) research "factors affecting employee productivity in the UAE construction industry" has shown that the number 1 ranked factor was proper work timing, giving a balance between work, recreation and time with family, leadership skills of supervisors, salaries paid on time, technical training, reasonably well paying job and safe, and job security. The research of Jarkas (2012) has ranked leadership skills of managers as 8th, skilled labour as 20th, while skilled labour was the 2nd in Ailabouni's research. Payment delayed was ranked 3rd in UAE, while it came 29th in Kuwait. Shortage of materials ranked 27th in Kuwait and 9th in the UAE.

In Gaza, Enhassi et al (2007) surveyed 83 contracting companies within the Gaza Strip, 33 of which were first-class contractors, 37 second class contractors, and 13 third-class contractors. They received a total of 76 completed questionnaires showing that the top ranked factors affecting labour productivity in building projects in Gaza were material shortages, lack of labour experience, lack of labour surveillance, misunderstanding between labour and superintendents, drawings and specification alteration during execution, and payment delay. These were the top ranked factors among the 45 factors surveyed. Comparing the results with other Arab and Middle Eastern countries (Kuwait and UAE), it was found that Enhassi et al (2007) has reached different top ranked factors than Ailabouni (2012) and Jarkas (2012). The top two factors were material shortages and lack of labour experience, which were ranked 27th and 22nd amongst the 45 factors that Jarkas has surveyed and was at the bottom towards the surveyed factors in the UAE. The sixth top ranked factor in Gaza was payment delay, and that was a common factor in both UAE and Kuwait since it was ranked in the first top 15 factors. This indicates there is a problem with payment delay in all three countries. It can be concluded from the research done in Kuwait, UAE and Palestine that although the three countries have a lot in common, such as traditions, culture, government funding and support, foreign labours, weather, similar salaries, similar laws and regulations, there is still a difference in the factors affecting labour in construction projects in each country.

Alinaitwe et al (2007) has conducted a research in Uganda of the “factors affecting the productivity of building craftsmen”. The respondents Alinaitwe et al, (2007) targeted were required to use their experience to rate 36 factors which affect productivity with respect to time, cost, and quality. Henry’s research is very important, as it shows that Sub-Sahara Africa construction industry is labour intensive. They are exposed to wet and extremely hot weather conditions and the working environment is hazardous. The research was done through questionnaires given to project managers who are registered in the National Contractors Association, and a response rate of 53% was received. The results show that the top ranked factors according to cost, time and quality are incompetent supervisors, lack of skills of the workers, rework, lack of tools/equipment, poor construction method, poor communication, and stoppages because of work being rejected by consultants.

In Iran, Ghoddousi et al (2012) have found that the top rated factors are utilizing traditional construction methods instead of modern technology, inexperienced site managers who cannot handle challenges that arise in the field, lack of proper tools and equipment on-site, unskilled operatives who cannot perform the task and incapability of site manager to train workers to perform their jobs properly. These results were computed by surveying the 31 factors that Ghoddousi et al (2012) have found based on literature review. They showed that the results obtained indicate that the main problems identified in past research in Iran still have remained the “predominant obstacles” in the path of increasing productivity. In conclusion the research paper shows that lack of materials and tools are the two main groups that are declining productivity, and suggests that contracting companies should provide material supply and schedule for materials delivery for every project.

The results achieved from “Critical Factors Influencing Construction Productivity in Thailand” done by Makulsawatudom et al (2004) agrees with the results obtained by Olabosipo et al (2011) in Nigeria, Ghoddousi et al (2012) in Iran, and Alinaitwe et al (2007) in Uganda. The top factors in Thailand were lack of material, incomplete drawings, incompetent supervisors, lack of tools and equipment, absenteeism and poor

communication. Makulsawatudom et al (2004) have offered suggestions in order to improve productivity by alleviating the effect of adverse factors. Makulsawatudom et al (2004) also suggested that improving labour productivity will make organisations more profitable, and increasing its chance of survival in the industry. These results are different from the ones obtained in New Zealand by Durdyev (2011). He sent 250 initial invitations, and he received only 37 responses (15% usable response rate). He targeted project managers, consultants, contractors, and subcontractors who had at least 15 years experience in the construction industry. 83% of the responses occupied high-ranking positions in their respective organisations as directors, managers, or associate directors. Rating the factors was, therefore, from highly experienced subjects who had the authority to make important decisions about productivity in their respective organisations. Durdyev (2011) argued that this added to quality and reliability of the feedback. He found that the top ranked factors were level of skills and experience of workforce, rework, adequacy of method of construction, site conditions (access, sub-soil, and topography), level of motivation commitment, supervision performance monitoring and control.

In Indonesia, Soekiman's et al (2009) research targeted small, medium and large companies. The authors wanted to see what factors related to labour productivity affect project schedule performance. They had broken the factors into four different groups; supervision, material, design, and equipment. After ranking all the factors in small, medium and large companies, Soekiman et al (2009) came up with the top 10 ranked factors in all companies (small, medium and large). Some of the top ranked factors were lack of material, delay in arrival of materials, unclear instruction to labourers, labour strikes, financial difficulties of the owner, and high absenteeism of the labourers.

More details are listed in table 2-3. The table summarizes all the different case studies discussed in the literature review. The main aim of the table is to show each researcher's categorization of the factors, total number of studied factors, response received, and the top ranked factors in each country.

Table 2- 3 Summary of the previous research done of the factors affecting labour productivity in construction projects in each country and how was the research conducted

Country	Author/Year	Response Received	Total Number of studied factors	Groups Divided in	Top ranked factors affecting labour productivity based on their Relative Importance Index rank method
India	Mistry Soham And Bhatt Rajv (2013)	51	27	Technological Human/labour Management external	Payment delay, skill of labour, clarity of technical specification, shortage of material, motivation of labour, construction method, and physical fatigue
Kuwait	Abdulaziz M.Jarkas and Camille G.Bitars (2012)	157	45	External Technological Human/labour Management	Clarity of technical specifications, extent of variation/change order, coordination level among various design disciplines, lack of labour supervision, proportion of work subcontracted, design complexity level, and lack of incentive scheme
UAE	Nabil Ailabouni, Kassim Gidado, and Noel Painting (2012)	238	32	Environmental Organisation work Policies Group/Team Dynamics Personal factors Manpower Management Environment	Proper work timing giving a balance between work and time with family, leadership skills of supervisors, salaries on time, technical qualified/educated for trade, reasonable well paying job, and safe secured job
United States	Mahesh Madan Gundecha (2012)	54	40	Manpower External Communication Resource Miscellaneous	Lack of required construction material, shortage of power and water supply, accidents during construction, lack of required construction tools/equipments, poor site condition, and insufficient lighting
Turkmenistan	Serdar Durdyev, Syuhaida Ismail, and Nooh Abu Bakar (2012)	124	23	Not divided into groups	Lack of local experienced labour, schedule pressure caused by government, working overtime, financial weakness of the contractor, rework, and inadequate financial policies of the government

Country	Author/Year	Response Received	Total Number of studied factors	Groups Divided in	Top ranked factors affecting labour Productivity based on their Relative Importance Index
Nigeria	Fagbenle Olasbosipo, Ogunde Ayodeji, and Owolabi James (2011)	80	12	Not divided into groups	Lack of training and retraining, poor communication, inclement weather, unfair wages, lack of motivation, negative influencing factors
New Zealand	Serdar Durdyeu, and Jasper Mabachu (2011)	37	56	Project finance Workforce Technology Project characteristics Project Management Unforeseen events Statutory Compliance External factors	Rework, level of skill and experience of the workforce, adequacy of method of construction, buildability issues, coordination and supervision, ground and site conditions.
Afghanistan	Sebghatallah Karimi and Kassim Gidodo (2010)	16	68	External Procurement Manpower Management Design Project related Materials and tools	Security (crime, theft and disorder), corruption, poor scheduling and coordination, construction method, low quality of raw materials, and payment delay
Malaysia	Umi Kalsum Zolkafi, Mahanim Hanid and Norhanim Zakaria (2010)	38	14	Not divided into groups	Lack of trades skill, waiting for materials, lack of tools and equipment, poor construction methods, project uniqueness, poor communication and lack of training.

Country	Author/Year	Response Received	Total Number of studied factors	Groups Divided in	Top ranked factors affecting labour Productivity based on their Relative Importance Index
Indonesia	A.Soekiman, K.S.Pridadi, and Seomardi.B (2009)	63	17	Supervision Material Execution plan Design	Lack of material, delay in arrival of materials, unclear instruction to labourers, labour strikes, financial difficulties of the owner, and high absenteeism of labourers.
Uganda	Henry Mwanaki Alinaitwe, and Jackson A. Mwaka (2007)	73	36	Time Cost Quality	Incompetent supervisors, lack of skills of the workers, rework, lack of tool/equipment, poor construction method, and poor communication
United States	Casey Jo Kuykendall (2007)	24	12	Not divided into groups	Management skills, schedule management, safety management, employee training/skills, employee motivation, and quality control
Gaza	Adnan Enhassi, Sherif Mohamed, and Zaid Abu Mustafa (2007)	83	45	Manpower Leadership Motivation Time Materials/tools Supervision Project Safety Quality External factors	Material shortages, lack of labour experience, lack of labour surveillance, misunderstanding between labour and superintendents, drawings and specifications alternation during execution, and payment delay
Sri Lanka	Wijekoon.S (2006)	60	20	Not divided into groups	Labour crew performance, design details, availability of skilled labour, accuracy of the estimates, constructability, and construction difficulties

Country	Author/Year	Response Received	Total Number of studied factors	Groups Divided in	Top ranked factors affecting labour Productivity based on their Relative Importance Index
Malaysia	M.R.Abdul Kadir, W.P. Lee and M.S.Jafar (2005)	100	50	Not divided into groups	Material shortage at project site, non-payment to suppliers causing the stoppage of material delivery to site, change order by consultants causing project delays, late issuance of construction drawing by consultants, and incapability of contractor's site management to organise site activities
Thailand	Arun Makulsawatudom and Margaret Emsley (2004)	34	23	Not divided into groups	Lack of material, incomplete drawing, incompetent supervisors, lack of tool and equipment, absenteeism, poor communication, and instruction time
Iran	Muhmood Zakeri and Paul O. Olomolaiye (1996)	172	13	Not divided into groups	Lack of materials, weather and site conditions, equipment breakdown, lack of proper tools and equipment, inspection delay, and absenteeism
Singapore	E.C.Lim and Jahidul Alum (1995)	67	17	Manpower Management Environment	Difficult in recruitment of supervisors and workers, high rate of labour turnover, absenteeism at the worksite, communication problems with foreign workers, inclement weather (weather conditions)

The researcher has created the following table to summarize what each researcher has done in previous studies. The table has helped the researcher to know which factors belong to which category. The researcher believed that a summarized table for the discussed case studies earlier will help him create the list of factors that he thinks might affect labour productivity

2.4 Egypt (Construction Industry) Case Study

Through the position it holds in the nation's economy, the Egyptian construction industry has an important effect on the country's social and economic growth and development. The sector has been growing by an average of 20% to 22% annually since 1980 (Hooper, 2012). With the high rate of population increase at 1.7% per annum (World Bank, 2013), construction work in Egypt is increasing rapidly to meet the needs of the growing population through the expansion of portable water systems, residential housing, hotels, sanitary drainage facilities and various infrastructure project (Wood, 2013). Total housing supply is expected to grow from 233,532 in 2006 to around 307,890 in 2014 (Yehya, 2012). The industry recorded a compound annual growth rate (CAGR) of 14.35% during the period (2007-2011), with steady economic growth and business friendly policies making the country increasingly attractive to foreign investors. Table 2-4 shows the construction sector spending from 2005-2015, making the Egyptian construction sector one of the largest in the Middle East, and the second largest in the Arab countries after Saudi Arabia (Encyclopedia of the Nations, 2013).

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Table 2- 4 Construction sector spendings from 2005-2015 in Egypt (source: Yehya, 2012)

The growth of the construction sector reached 4.25% in 2011 and will rise to 5.63% in 2014, making it the second most intensive labour industry after agriculture (Yehya, 2012). Table 2-5 shows the increase in labour force from 2009-2013 and the number of labourers working in the construction industry.

Table 2- 5 Total construction labourers out of total work force in Egypt (CAMPS, 2013)

The predominant “traditional contract strategy“ construction project delivery method practiced in Egypt it is based on “Design-Bid-Build” (El-Gohary et al, 2013). This method breaks into three phases, the design phase, the bidding phase, and the construction phase. The benefits of this method are that the design team looks out for the interest of the client. In the second phase, contractors place bids based on the design team’s prepared documents. The third phase makes the client decide to whom the project should be given, and it also gives the client an idea of the overall cost of the project.

2.4.1 Construction Labour in Egypt

Construction is a labour intensive industry, and it can be argued that labour power is the only productive resource. Hence, construction productivity is mainly dependent upon human effort and performance (El-Gohary et al, 2013). Most of the construction workers in Egypt come from Upper Egypt (the southern part of the country). They usually move to Cairo for high wages, regular work, a more exciting life, lack of rural job opportunities, and most importantly it gives them the chance to remit cash in order to support family members at home in the village (Zohry, 2002). Their basic goal is simple “make and save as much as possible, then go back home” (El-Gohary et al, 2013). The construction industry continues to face shortages in skilled labour, since most of the construction workers travel abroad. They travel to countries like Libya, Kuwait, Saudi Arabia, Iraq, United Arab Emirates, Bahrain, and Qatar, to earn a better income.

2.4.2 Construction Market Risk in Egypt

Since the 2011 revolution, the country's construction industry and economy has been at risk. The revolution has been more detrimental to the unemployment rate than was expected. The United Nations say that 90% of unemployed Egyptians are under the age of 30, which adds more pressure on the government to develop an economic system to improve the country's GDP and employment rate. Egypt has become a high-risk country due to ongoing political issues; its score is above the world average (Yehya, 2012). Scarcity of skilled labour, growing unemployment, decline in construction projects, low productivity, high tax scheme, rising security concerns, and time consuming legal procedures are all affecting the country's economy by increasing the economic risk on the long term. In general it can be stated that the country is risky for any business operations. The Egyptian government is currently trying to calm things down to attract private and foreign investors (Yehya, 2012)

2.4.3 Building Companies after the Revolution

The top three contractor companies in Egypt are Orascom Construction Industry, Arab Contractors, and Talaat Moustafa Group. Talaat Moustafa Group has announced a decline in turnover by 40% in May 2011 to 202m pounds. Osama Bishai (Chief operating officer of orascom construction industry) said "in the past, ministries had clear plans for infrastructure projects, but now they are focusing on day to day problems and no one is thinking about this industry, which is a big employer" (Saleh, 2011). The revolution had a direct effect on government funded projects, luxury residential and home building programmes that provided income to different construction parties (Clients, Small/Medium suppliers, contractors, and labour) (Saleh, 2011). Ibrahim Mahlab chairman of Arab Contractors said: "Our suppliers are beyond desperation; they are doing little of business on a cash and carry basis. This is not how it usually works but it is happening with small companies selling timber, or tools and building materials". Arab Contractors had dropped 25% of its profit by the end of December 2011. They started to seek projects outside the country, for a bigger profit margin. Ibrahim Mahlab has also mentioned that the Arab Contractors company is "an elephant, you have to feed it a big potato everyday. If you just give it a little bit of rice, it will die". Osama Bishai has also stated that "construction should be looked at as the catalyst to rebuild the country, the sector creates direct and indirect employment opportunities for four to five million

people”. All three contracting companies have been trying to improve the construction sector by accepting decreased profit margin, and using outside bank loans to fund ongoing projects.

2.4.4 Construction Industry after February 2011 and June 30 Revolution

After the 2011 and 2013 revolutions, projects are becoming more important to Egypt as a developing country to achieve its goals because it affects the country's Gross Domestic Product (GDP) and employment rate. Construction activities continue to suffer from the ongoing political upheaval in Egypt, and it is expected that the industry will face further uncertainty over the next term (Report buyer, 2012). In 2011, the construction sector declined by 9.1% and in 2012 by 0.6%. Private sector investments dropped from EGP44.28 million in 2010 to EGP40.04 million in 2011 (Al-Youm, 2012). Major challenges are facing the Egyptian government in managing the state budget, which includes salaries for the public sector and subsidies, items that account for more than half of all public expenditure. The “Commercial International Bank” has announced an 11% decline in profit in August 2011 compared to the same period last year to 443 million Egyptian pounds (World Bank, 2013). Unemployment levels had hit 9.4% and foreign direct investments had fallen by 31%. GDP growth was also effected, decreasing by 2.2% between October-December of 2012/2013. Investments also declined to 13% of GDP in July-December 2012 (World Bank 2013). After the revolution, the government's plans for new infrastructure projects have decreased and the private sector's ongoing projects have been slowly progressing due to the bank being unwilling to lend money for construction projects (Hooper, 2012). The government also blamed some of the construction drop in on labour strikes and protests. The new government after the revolution had to find ways to boost the construction industry. They managed to attract investment and loans from Kuwait, Saudi Arabia, United Arab Emirates, and Qatar. The World Bank has announced that it will provide a US\$240 million loan to the Egyptian government in order to financially support the construction of a 1,500MW natural gas turbine power plant. The European Investment Bank (EIB) has also committed to lending US\$900 million a year to support construction work in Egypt (Report buyer, 2012).

2.4.5 Explanation of Upper Egypt

Upper Egypt is the strip of land, on both sides of the Nile valley, that extends between Nubia, and downriver (northwards) to Lower Egypt (World Bank, 2012). It can also be called the southern part of the country and consists of nine governorates (An administrative division of a country) –namely,

- Giza
- Faiyum
- Beni Sauf
- Minya
- Asyut
- Sohag
- Qena
- Luxor
- Aswan

These nine governorates generate nearly half of Egyptian land (Matawh, 2012). Figure 2-2 shows all 27 governorates of Egypt, while Figure 2-3 shows the 9 governorates that form Upper Egypt.

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Figure 2- 2 Egypt Map with all 27 governorates (CIA Library, 2014)

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Figure 2- 3 Highlighted are 9 governorates that form Upper Egypt (CIA Library, 2014)

The Egyptian government has also included Giza as the first and most populated governorate in Upper Egypt. Table 2-6 below shows the increase of population of the 9 governorates from 2006-2013 and their area, adding up to 36.5% of Egypt's population (Approximately 31 million), of whom 60% are in poverty and 80% in severe poverty (Matawah, 2012). The quality of healthcare is considered inadequate, with doctors, pharmaceuticals and specialized services unavailable (World Bank, 2012).

Table 2- 6 Population and Area of each Upper Egypt Governmate (CAMPS,2013)

More than 50% of the Egyptian population is under the age of 29. With 47.4% of the population uneducated and 38% unemployed, Upper Egypt adds a lot of pressure to the Egyptian government and increases employment problems. The government thinks the private sector is the only solution to the problem. According to the 2012 World Bank report, “Upper Egypt is considered the most culturally conservative and traditional region of the country, where patriarchal values and tribal customs continue to inform local attitudes and behaviour” (Zohry, 2002). Families in Upper Egypt still see the man as the only source of income, with 70% of young women jobless, and less than 4% of illiterate females employed (World Bank, 2012). With the increasing population, government jobs continue to be viewed as the only socially acceptable form of employment in Upper Egypt especially for women.

2.4.6 Problems with Upper Egypt Workers in Construction

Most workers who come from Upper Egypt are untrained, unlicensed (therefore unofficial), uninsured, and at the mercy of the contractor who gives them a job (Harding, 2012). The cost of these workers is less than quarter of the average prevailing in the Middle East and North Africa. They are forced to accept low wages, and to work overtime to satisfy the contractor who would then ask for their service the day after. The contractor pressurises the workers into working seven days a week instead of six, with no time off (Shehata et al, 2011). This results in fatigue, declined morale, impaired

judgment, increased absenteeism, and the occurrence of errors and other problems (AbdelRazek.et al, 2007).

The high growth rate of population and high unemployment rate have resulted in a large numbers of young people working in construction projects (CAMPS, 2012), they

- Are inexperienced
- are poorly educated or uneducated
- receive low wages
- demotivated
- don't understand project success and completion of work on time
- have family problems
- pay high taxes (skilled workers)
- are unqualified

These workers have been facing all sorts of problems, including not getting paid for completed work on time, living in miserable conditions, having to pay for their own healthcare, and being unable to save for the future. Most of the contractors blame any project failure on workers, claiming that they are untrained (Zohry, 2002). These workers have been accepting very hard living conditions in order to support their families in the villages. Some contractors take advantage of that, demanding workers to do more work for less money. Unfortunately, these workers have no other option but to accept until a better job opportunity presents itself.

2.5 List of factors and their groups that might affect labour productivity in Egypt

Based on the different case studies reviewed, the researcher has come out with a list of factors that he thinks might affect labour productivity in the Egyptian Construction Industry. The list was created based on previous case studies discussed in the literature and chose the factors that suit the country's cultures and traditions. For example "sent home for being drunk on site" cannot be one of the factors the research can add to the list. This is due to the high population of the country being Muslims where alcohol is not

allowed in their religion. Beside alcohol is only sold in certain places in Cairo during night time. The researcher chose the list based on taking the top 10-15 factors he found in each case study he has discussed in the literature. It was clear to the researcher from the literature review that certain factors were used in all previous studies such as payment delay, rework, lack of skills and experience, absenteeism, personal/family problems, shortage of material, on site accidents, labour age, on-site accidents, tool and equipment shortage and so on. Other factors the researcher has found that were used in studies that took place in Afghanistan, Turkmenistan, and Uganda that he thought might affect labour productivity in the Egyptian construction projects that were not used in Kuwait, UAE, Gaza, Indonesia and USA. For example security (crime and theft), Natural disasters, and working 7 days a week without rest. The list of factors will then be used to provide a questionnaire, after going through pilot study to make sure construction professionals agree that these factors can be used for this research. It can be stated that human/labour factors consisted of 15 factors, Management Factors 18 factors, External Factors 9 factors, and Material Factors 9 factors. Table 2-7 shows the factors and which group it is classified under. The researcher has created the list from his point of view of the factors he thinks affects labour productivity based on same culture studies (Middle East + Africa) but was not limited to these studies.

Human/Labour Factors	Labour motivation Physical fatigue Lack of skills Lack of experience Undisciplined labour Lack of competition Labour age (young/older) Communication problems between labour and Supervisors Personal/family problems Labour disloyalty Labour strikes or walkout Absenteeism Arguments between workers Dissatisfaction of labour Working 7 days a week without taking day off
Management factors	Lack of supervision leadership Payment delay Lack of training sessions for labours Incentive scheme Rework Misunderstanding among client, contractor, designer Construction method Clear goals and targets Inspection delay Offered services for labour (union membership, Life insurance, medical care etc...) Late payment from client to contractor Unrealistic scheduling and expectations of labour expectations Lack of periodic meeting with labour Design changes Incapability of contractor's site management to Organise site activities Eid Bonus Free Lunch Pickup and drop off service
External factors	Poor site condition On-site accidents Weather (High wind, hot temperature, rain and sandstorms) Law and Regulations change by government Shortage of power supply/water Access to site Natural disasters (flood, hurricane, landslide) Insufficient lighting Security (crime and theft)
Material Factors	Delay in material delivery on site Tools and equipment shortages Low quality of raw material Material storage location Increase of material price Damaged materials on site Waiting for equipment to arrive Material shortage Inefficiency material on site

Table 2- 7 List of factors and group the researcher thinks might affect labourers productivity in Egyptian Construction Industry

2.6 Summary

Chapter 2 presented the definition of productivity and its definition in the construction industry. Previous studies were discussed to help the researcher understand the factors which affect labour productivity in different countries. The researcher has then developed a potential list he thought are the factors that might affect labour productivity in the Egyptian Construction Projects based on previous research discussed in the literature. The next chapter will discuss the methodology used and the structure of the questionnaire. The chapter will also present the findings of the questionnaire.

Chapter 3 Research Methodology

3.1 Introduction

This chapter presents the methodology and research philosophy adopted in this research. As stated earlier, construction projects are very important to Egypt especially since the revolution. Labour productivity is one of the main topics that can improve success of any construction project if finished on time, to standard quality, and on budget. The knowledge of philosophy can “help the researcher recognize which designs will work best and it enables the achievement of a satisfactory outcome for the research quality” (Saunders et al, 2009). Firstly, efforts were carried out in order to identify the factors affecting labour productivity in different countries’ construction projects. Secondly, the factors affecting labour productivity in Egyptian construction projects were identified. Then a questionnaire was constructed based on these factors. This questionnaire was then distributed to construction professionals, who were asked to rank the factors. The researcher then analyzed the results. Finally, interviews with professionals were carried out to discuss the results obtained from the questionnaire, and to determine how the problem can be addressed. Therefore, the research methodology is used to fulfill the aims/objectives and research question stated in Chapter 1. The choice of the research methodology depends on the research subject, the professional respondents and the methods used (tools and techniques).

Research question:

Accordingly, the research question that can be derived for the above-mentioned discussion is as follows; What are the factors that cause a decline in labour productivity in the Egyptian construction industry, causing a risk of project failure? How could these factors be improved respectively?

Research Paradigms	Research Approach	Research Method
Positivist	Quantitative	Surveys Longitudinal Experimental
Interpretivism	Qualitative	Biographical Phenomenological Ethnographical Case study

Table 3- 1 Summary of Research Philosophy

Table 3-1 shows this relationship between the research paradigms and research approach.

3.2 Research Process

The researcher was influenced by the diagram of Naoum (2007) that shows the narrowing down of the research topic. Figure 3-1 shows step by step the work undertaken by the researcher in conducting his research to accomplish the aim/objectives.

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Figure 3- 1 A copy of diagram showing the narrowing down of the research topic (Naoum, 2007)

Chapter 1 included an identification of topic and aim/objectives. It was followed by chapter 2 that discussed four main parts: 1) identified factors affecting labour productivity in different construction projects around the world 2) existing problems that Egyptian construction labourers from rural cities face. 3) Background of the Egyptian construction industry especially after the 2011 and 2013 revolutions. The study of different case studies in different countries helped in developing a fundamental

understanding of labour productivity and the factors affecting their performance. 4) a potential list based on the literature review case studies of factors that might affect labour productivity in Egyptian construction projects. In chapter 3 (Methodology) the design process was explained, followed by the methods used to complete the research. A questionnaire was designed according to the information collected.

More literature was then reviewed at, this time to compare and contrast the data collected and analysed. It focused on the ranking of factors in different countries, and the reasons that cause some factors to be highly ranked in the Egyptian construction industry, compared to other countries. Interviews were also conducted face to face with professionals to give a better understanding of the problems and their point of view of how the problems might be fixed and what assistance the labourers need.

After the analysis of the results, interviews were carried out with contractors and construction project managers with 20 years of experience. The in-depth interviews were done to get a good understanding of the problem. These managers have been in the industry for quite some time and have experienced the problems based on real life projects. The interviews will give the researcher a better understanding of the weaknesses in the Egyptian construction industry's labour productivity and promote suggestions on how to reduce the problem. On completion of the analysis of the interviews and questionnaires, the researcher thin identify the factors affecting labour productivity in Egyptian construction projects and give recommendations on how to improve their performance.

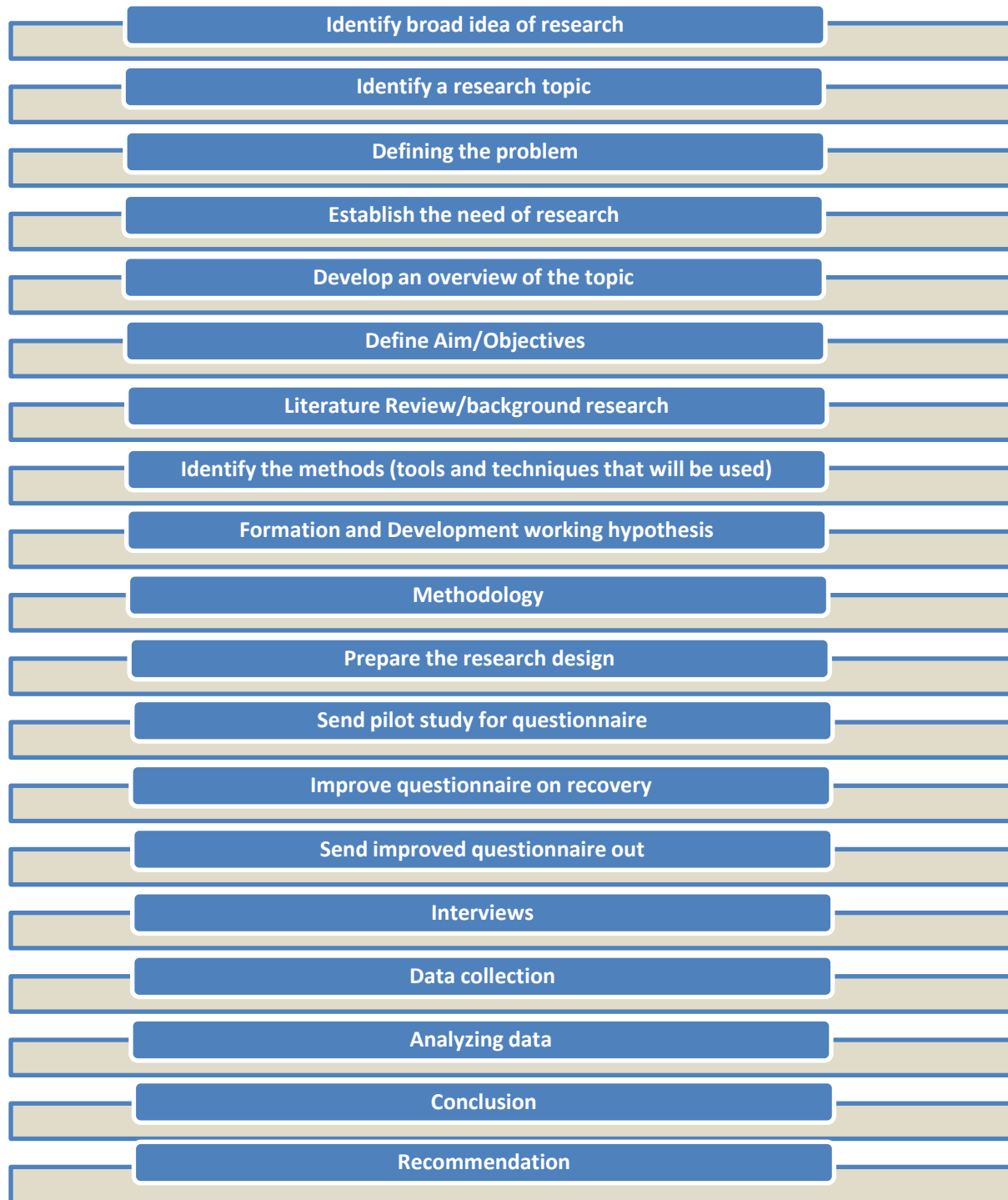


Figure 3- 2 Research Process

3.3 Research Design

3.3.1 Research Philosophy

Following the literature review, the researcher has developed a list of factors that he thinks can affect labour productivity in Egypt's construction projects. Fundamentally labour productivity recognizes the relationship between different construction professionals and shows where the weaknesses are and the factors that need to be improved. Chapter 2 (Review of Literature), has classified the factors into 4 different groups to gain a better understanding, and to see which category affects labour productivity the most. Despite all the technological advancements, there are still major problems that the Egyptian construction industry is facing. These problems include material shortage, lack of tools, and other factors that result in delayed completion of projects and added costs to the budget. Understanding the research aim/objective guides the researcher to the right direction to accomplish them. This agrees with Saunders et al, (2009) who argues that "research philosophy as the development of the research background, research knowledge and its nature. The knowledge of philosophy can help the researcher recognise which designs will work best and that it enables the achievement of a satisfactory outcome for the research activity".

To achieve the aim/objectives, the researcher was influenced by Cohen et al (2011) Brown et al (2011) Saunders et al (2009), Naoum et al (2007) Burke et al (2005) who have all discussed different research paradigms and research approaches. (Thomas Kuhn, 1962) book "The structure of scientific revolution" has defined the paradigm as a "comprehensive model of understanding that provides a field's member with viewpoints and rules on how to look at the field's problems and how to solve them". According to Burke et al (2005) a research paradigm is "a perspective that is based on the set of shared assumptions, values, concepts, and practices. In other words research paradigm can be a combination of two ideas that are related to the nature of world and the function of the researcher". That also agrees with Gilner et al (2000) "paradigm is a way of thinking about and conducting a research. It is not strictly a methodology, but more of a philosophy that guides how the research is to be conducted".

As a result of the research philosophy discussed earlier, the research will be conducted using mixed method of questionnaires and interviews.

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Figure 3- 3 Saunder's Research Onion (Saunder et al, 2009)

The researcher was influenced by Saunder's research onion (Saunder et al, 2009) that can be found in figure 3-4 to where the mixed research methods used will then lead to data collection and data analysis.

3.4 Research Data

3.4.1 Primary Data

Primary data was collected by a mixed method of quantitative and qualitative research. Primary data has many advantages, such as being accurate and reliable. If done correctly, it can answer direct research questions. It is also up to date, applicable and useable. Naoum (2007) defines quantitative research as "Objective" in nature. It is an inquiry into a social or human problem, based on testing a hypothesis or a theory composed of variables, measured with numbers and analysed with statistics. Brown et al, (2011) defined quantitative research as "the use of predominantly closed questions or statements with fixed alternatives, careful attention to sampling design and the use of statics to the test hypothesis. In other words, the main instrument for testing this hypothesis is data collection which will be done through a questionnaire. The researcher believes that the main method of research will be a quantitative method since quantitative research is based more directly on its original plans and its results are more readily

analysed and interpreted. With the above definition taken into account, this research is classified as quantitative and the main purpose is to identify the factors affecting labour productivity in Egyptian construction project. Therefore the initial idea was to use a structured questionnaire to rank the factors listed in section 2.5.

3.4.2 Secondary Data

The research will consist of both secondary and primary sources before performing the questionnaire. Secondary sources are studies in the same area of the research to gain a better understanding of the topic. Examples of these secondary sources are books, magazines, journal papers, dictionaries, and Internet sources (Brown et al, 2011). Based on secondary data, the researcher identified 113 factors that affect labour productivity in construction projects. The secondary data had many advantages to the researcher, it was inexpensive, easily accessible, and also alerted the researcher to any potential difficulties.

The research started with articles and books on the importance of labour productivity in the construction industry. Several articles found stated that labour can cost up to 50% of the overall construction budget. Labourers in the Egyptian construction industry have been facing all sorts of problems that have been stated earlier in chapter 2. Looking at the different factors affecting labour productivity in different construction projects, a start was made to the literature review.

3.4.2.1 Structure of Questionnaire

There are various ways for a survey to be structured. It can be sent by email, completed on the telephone, completed during face to face interviews, or by observations. The surveys in this research were done using the questionnaire method. This agrees with Ailabouni et al (2009) who argues that “surveys operate on the basis of statistical sampling aimed at speed economy, very rarely and full population surveys possible, practical or desirable, whilst the most method of survey is through the use of questionnaire”. With Yin (2009) stating if the research question has “What” then a questionnaire should be used. Although there will be face to face interviews, the researcher believes that a questionnaire will be the main method to reach the research aim/objectives.

Figure 3-4 shows an explanation given by Naoum (2007) to guide the researcher in order to reach to the questionnaire questions.

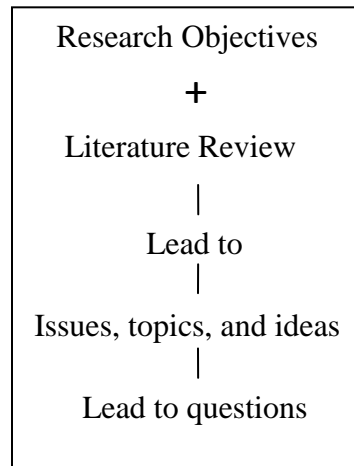


Figure 3- 4 Structure of Questionnaire

El-Gohary et al (2011) stated that a questionnaire has a definite advantage, “a questionnaire requires a smaller time to be responded and is more accurate in the final outcome”. Another advantage is that questionnaires are simple, can be sent to all respondents, and gives the researcher the opportunity to compare the results of several organisations. The type and style of questionnaire should contain certain aspects 1) it should avoid lengthy questions so as not to waste participants’ time. 2) avoid a low useable respondent percentage 3) avoid confusing questions that can be easily misunderstood, resulting in a low participation rate. Closed questions are the most suitable form of questions to be used in that case, where participants are only required ticks in boxes. That agrees with what Brown, et al (2011) stated, that “closed questions in questionnaires usually require little writing-only ticks or crosses but they do require careful reading and usually some thought”. Brown has also mentioned that the closed questions should “express in a language familiar to the respondents”. The researcher believes that the word language here represents more the professional terms used other than the translation of language from English to Arabic. Naoum (2007) argues that closed questions are easy to ask and quick to answer, they require no writing by either respondents or interviewer, and their analysis is straightforward. Therefore, the questionnaires were translated into Arabic. Because the majority of respondents cannot read/write in English, the researcher decided to go with the Arabic translation to make

sure the questionnaire is understood clearly and to get a high number of useable questionnaires. Respondents were given one day to complete the questionnaires before collecting them back.

The questionnaire was divided into four different categories: human/labour factors, management factors, external factors, and material factors (section 2.5). The arrangement of the factors was random without any particular order, to avoid giving the participants any indication of any preference answers. A five point likert measurement scale was used to rank the degree of importance. It is an ascending scale of 1- Strongly not important to 5- very important. The likert scale is very easy to use and will not require a lot of effort from professionals. Although the likert scale has limitations, it has been used in the majority of previous research (Soham, 2013; El-Gohary et al, 2013; Ghoddousi, 2012; Olabosipo et al, 2011; Adamu et al, 2011; Enhassi et al, 2007; Alinaitwi et al, 2007; Njeri, 1999)

Questionnaire

Name: _____ **Company Name:** _____
Job Title: _____ **Date:** _____
Year of Experience: _____

If you may please tick the box by (✓) for the answer the most suits the "factors affecting labourers productivity in Egypt Construction Projects"

Note: Answer "1" mean Strongly not important, "2" mean Not important, "3" mean Neutral, "4" mean Important, "5" mean Very important

Num	Factors Affecting Labour Productivity	Degree of Importance					Comments
		1	2	3	4	5	
	Human/Labour Factors						
1	Indiscipline labour						
2	Physical fatigue						
3	Personal/family problems						
4	Arguments between workers						
5	Working 7 days a week without rest						

Figure 3- 5 Snapshot of English questionnaire

3.4.2.2 Pilot Study

A pilot study was conducted to validate and improve the questionnaire. According to Hertzog (2008) sample size for pilot study can be considered as 5% of the questionnaires distributed. A draft of the questionnaire was given to 13 (5% of 258 distributed questionnaires) construction project managers in Egyptian construction projects, who have more than 10 years of experience. The aim of the pilot study was: 1) to test the questionnaire based on its format (layout), 2) to test the wording of questions, 3) to validate the list of factors being surveyed, 4) to test the measurement scale, 5) To test the accuracy of the Arabic translation. The draft questionnaire was collected back from respondents, and certain changes were made to the factors list and to the questionnaire. It was then approved before being circulated. The factors were reduced from 53 to 41, since the construction project managers thought factors such as drunk on site and drugs were not suitable for the Egyptian culture. Plus they thought some factors can be joined together, for example instead of having different factors for the weather, one factor named weather and in brackets says the different environments. Arabic grammar and spelling of the questionnaire was corrected, and the overall design was also improved.

استقصاء رأي

الاسم: _____
 الوظيفة: _____
 عدد سنوات الخبرة: _____

الشركة: _____
 التاريخ: _____

الرجاء من سيادتكم بأن تملأوا بوضع علامة (✓) على الإجابة الأنسب للأسئلة التالية الخاصة بالعوامل المؤثرة على الإنتاجية العمالة في صناعة التشييد المصرية

ملاحظات: الإجابة "1" تعني تأثير ضعيف جدا و الإجابة "2" تعني تأثير ضعيف. الإجابة "3" تعني تأثير متوسط. الإجابة "4" تعني تأثير قوي . الإجابة "5" تعني تأثير قوي جدا

رقم	العوامل المؤثرة على الإنتاجية العمالة	درجة التأثير					ملاحظات
		5	4	3	2	1	
	عوامل تتعلق بالعمل نفسه						
1	عدم التزامات العمالة						
2	الإرهاق الجسدي						
3	المشاكل الشخصية والعائلية						
4	الجدل بين العمال						

Figure 3- 6 Snapshot of Arabic questionnaire

3.4.2.3 Interviews

Brown et al (2011) define interviews as a “conversation with a purpose”. Their purpose is obtain answers to the broad reach questions. There are different method of interviews, they can either be done face to face, by telephone, using Skype, or video-linked. The richest way of data collection, is the face to face interview, if this is possible. Although they can be very time consuming, the advantages of face to face interview include the possibility to control the flow of primary data collection processes and the possibility to cover the project issues in an in-depth manner (Saunder et al,2007). The interviews in this research consisted of structural interviews that are asked for each interviewee in the same manner. Data collected by conducting structured interviews is perceived to be associated with a high level of validity. Saunder et al (2007) stated that interviews should be conducted in a safe environment, quiet environment, so that nothing disturbs the respondent, or stops the flow of the discussion that is going over the topic. The researcher contacted the respondents in May and the all the interviews will take place in July, when the researcher is in Egypt to visit the respondents’ offices. The interview contained five questions where the researcher wants to see the respondents opinions to the questionnaire, and also if there is a solution to reduce the problem. There were only five questions due to the fact that the researcher did not want to take too much of the respondents’ time, since the interviews will take place during the day and they are at work. The interviews consisted of discussions where the researcher asked questions and the respondents answered, and also different points of view were discussed. The researcher has managed to complete six interviews with professionals at senior manager level in the Egyptian Construction Industry. These senior managers have more than 20+ years of experience.

3.5 Sampling

Although there is not a set rule for the number of questionnaires that should be distributed, the aim of the researcher was to reach a high number of respondents to fulfill the objectives. Naoum (2007) states that “selecting the research sample is very important and great care must be taken when choosing the type of sample design”. The contractors will be the ones who are registered in the Egyptian Federation of Construction and Building Contractors (EFCBC). Being registered in the EFCBC means that the contractor holds a license to work legally (El-Behary, 2013). There are more than 16,400 contractors

registered with the EFCBC in 2014, compared to 41,000 contractors in 2010 (El-Behary, 2013). That huge drop was either a result of contractor bankruptcy or change of career. All contractors are divided into seven groups. These groups differ based on the annual income, number of employees, projects size, tool and equipment rented or owned, number of engineers, and years of contractor experience.

The researcher has decided to target contractors within the first three classes. The first class included 188 contractors, the second includes 276 contractors, and the third 312 contractors. The three classes add up to a total of 776 contractors. (Hogg et al, 2010) expressed the formula below to determine the sample size, the formula was also used by other researchers (El-Gohary et al 2013; Jarkas, 2012 Enhassi et al, 2011; Ailabouni et al, 2009)

$$n = \frac{m}{1 + (\frac{m-1}{N})}$$

n= sample size of limited population

m=sample size of unlimited population

N= available population

The only unknown in this equation is the value of m, which can be calculated using the following equation.

$$m = \frac{Z^2 \times P \times (1-P)}{\varepsilon^2}$$

Z is the statistical value of the confidence level used i.e 2.575, 1.96 and 1.645 for 99%, 95% and 90% confidence levels. Since P is unknown Sincichet, (2001) stated that value of 0.50 should be used as sample size. ε is the maximum error of the point estimate. Using 95% confidence i.e 5% significance level, the unlimited sample size of the population “m” is approximately calculated as following

$$m = \frac{1.96^2 \times 0.50 \times (1 - 0.50)}{0.05^2} = 385$$

For the total number of targeted contractor under first, second, third class in EFCBC, N= 776, the representative sample size was calculated as follow:

$$n = \frac{385}{1 + (\frac{385 - 1}{776})} = 257.57 = 258 \text{ Contracting Companies}$$

Based on the following equation a total number of 258 contracting companies in Egypt will be surveyed as a sample to represent a sample of a total of 776 contractors. The respondents vary from project managers, construction managers, supervisors, engineers, architects, and consultants in their organisations. They have a minimum of 5 years of experience, followed by up to 10 years of experience, and 15 years of experience.

3.6 Primary Data Analysis

For analysing the data, Relative Importance Index technique was used and is calculated using the following formula:

$$\begin{aligned} &\text{Relative Importance Index (\%)} \\ &= \frac{5(n_5) + 4(n_4) + 3(n_3) + 2(n_2) + n_1}{5(n_1 + n_2 + n_3 + n_4 + n_5)} \times 100 \end{aligned}$$

The relative importance index was used to rank the factors. Where n1, n2, n3, n4, and n5 are the total number of respondent who selected “1” Strongly not important, “2” Not Important, “3”Neutral, “4” Important, “5” Very Important. The factors were ranked based on an average of the experience of the construction professionals.

The factors were ranked using the Relative Importance Index by Microsoft Excel spreadsheet. All the data was inserted into a spreadsheet to rank the factors. After putting all respondents questionnaires into the spreadsheet, a double check was done to make sure that the data was entered correctly.

3.7 Result of Questionnaire

The questionnaire data was entered on Microsoft Excel after being designed by the researcher to get a percentage. Two methods of ranking were used: 1) all ranked factors and 2) group ranked factors. The factors were categorised into four different groups (human/l factors, management factors, external factors, material factors), making a total of 41 factors.

Following is a summary of the questionnaire conducted for establishing the factors affecting labour productivity in the Egyptian Construction Industry

Total questionnaire sent = 258

Number of questionnaire received = 227

Type = Hard Copies

Time taken to collect data = 60 days

% of questionnaire received = 87.98%

The rank of each group was established by quantifying the average value of the importance indices for all factors. The factors were ranked using the Relative Importance Index by Microsoft Excel spreadsheet. A double check was done to make sure that the data was entered correctly with each respondent's years of experience.

Example of how the factors were calculated for "Undisciplined labour" factor

n5 = 107 for "Very Important"
n4 = 69 for "Important"
n3 = 30 for "Neutral"
n2 = 15 for "Not Important"
n1 = 6 for "Strongly Not Important"

Relative Importance Index (%)

$$= \frac{5(n5) + 4(n4) + 3(n3) + 2(n2) + n1}{5(n1 + n2 + n3 + n4 + n5)} \times 100$$

Therefore:

$$= \frac{5(107) + 4(69) + 3(30) + 2(15) + 1(6)}{5(6 + 15 + 30 + 69 + 107)} \times 100$$

$$= 82.55\%$$

Respondent	Number
Engineers	98
Foremen	33
Site Supervisors	32
Construction Managers	27
Project Managers	18
Quantity Surveyors	12
Architects	7
Total	227

Table 3- 2 Number of Respondent and their professions

Pie chart illustrating the distribution of respondents.

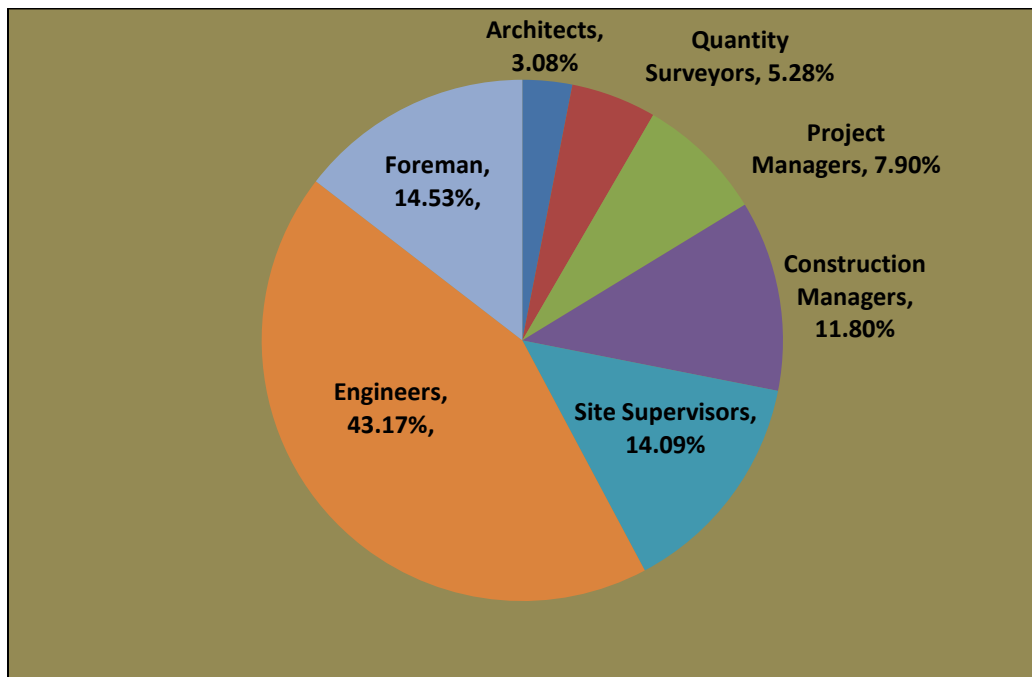


Figure 3- 7 Percentages of Respondents for Each Professional

Table 3-2 shows the percentage of the professions surveyed, out of the 227 questionnaires received. It can be stated that Engineers made up 43.17% of the total respondents. Engineers are those who work in offices or on sites. Table 3-3 shows the

respondents and the years of experience they have spend in the Egyptian construction industry. Each year of experience group has the number of respondents who belong to it.

Years of Experience	Total number out of 227 respondents
0-5 years	37
5-10 years	94
10-15 years	62
15-20 years	20
20+ years	14

Table 3- 3 Respondents and their years of experience in the industry

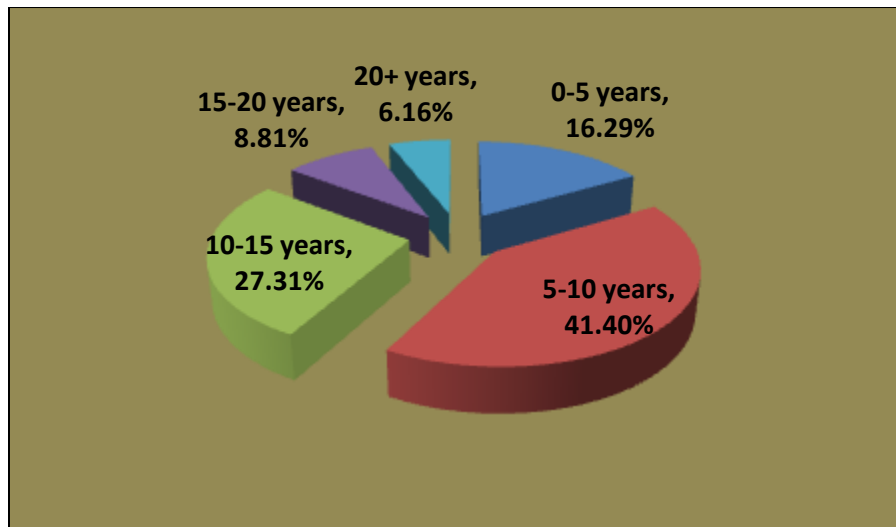


Figure 3- 8 Percentage of respondents' experience year in industry

3.8 Research Ethics

The researcher has taken into consideration the university's ethical regulations in order to conduct this research. Since all the questionnaires had to be given out as hard copies, an Arabic paragraph was written at the beginning of the questionnaire explaining that all respondents' personal details and opinions were to remain confidential and would not to be shown to any third party under any circumstances.

3.9 Research Limitations

Due to time and resource restrictions, the research thesis targeted the first three classes only (776 contractors out of 16,400 contractors). The sample was only taken from Cairo, the capital of Egypt. Due to time limitation another questionnaire could have been distributed to the labourers with another list of factors that they think affect their performance on site. Some of the respondents did not feel comfortable completing the questionnaire since they didn't have permission from the project manager.

3.10 Chapter Summary

This chapter has discussed the methodology used and the structure of the questionnaire, followed by sample size and pilot study before the questionnaire was sent out to construction professionals. Additionally, the findings of the questionnaire were presented. The next chapter presents an analysis of the data collected and presented in chapter 3.

Chapter 4 Results and Data Analysis

4.1 Introduction

Following the Literature Review (Chapter 2) and the Methodology (Chapter 3) results and analyses of the questionnaire are presented in this chapter. 258 questionnaires has been distributed to construction professionals in the Egyptian Construction Industry to complete. This chapter focuses on presenting the results gathered from the questionnaire and ranks the “factors affecting labourers productivity” using the Relative Importance Index method. Each table will present the factors ranked under the group in which they were categorized. Furthermore the factors were then ranked from 1-41 according to their value of Relative Importance Index. It is clear from the results presented in table 4-1 that out of the four groups “human/labour” factors were ranked first with (77.73%), followed by material factors (77.62%), management factors (73.65%), and external factors (73.10%).

Table 4- 1 Group Ranking according to Average Relative Importance Index

Factor Group	Relative Importance Index (%) Average	Rank
Human/Labour Factors	77.73%	1
Material Factors	77.62%	2
Management Factors	73.65%	3
External Factors	73.10%	4

The ranking of the groups are very close to each other, with all group factors have a Relative importance index above 70% this might be due to bias in the questionnaire, error in understanding the questionnaire, and respondent are busy so they fill the questionnaire quickly without reading it carefully.

4.2 Human/Labour Factor

The results indicated in table 4-2 states human/labour factors group were ranked 1st with an average Relative Importance Index of 77.73%, which proves that the main factors affecting labour productivity are human/labour factors. Five out of the ten factors had a Relative Importance Index of 79% and above, where they were ranked in the first 16 factors out of 41 in total.

Factors	Relative Importance Index (%)	Rank
Undisciplined labour	82.55%	1
Labour experience and skill	81.96%	2
Personal/family problems	80.37%	3
Working 7 days a week without rest	79.47%	4
Absenteeism	79.21%	5
Labour motivation	77.62%	6
Arguments between workers	75.67%	7
Physical fatigue	74.47%	8
Labour age (old/young)	74.27%	9
Communication problems between labour and supervisor	71.58%	10

Table 4- 2 Human/Labour Factors ranking that affect labour productivity

Figure 4-1 shows a chart of how the factors were ranked according to their relative importance index.

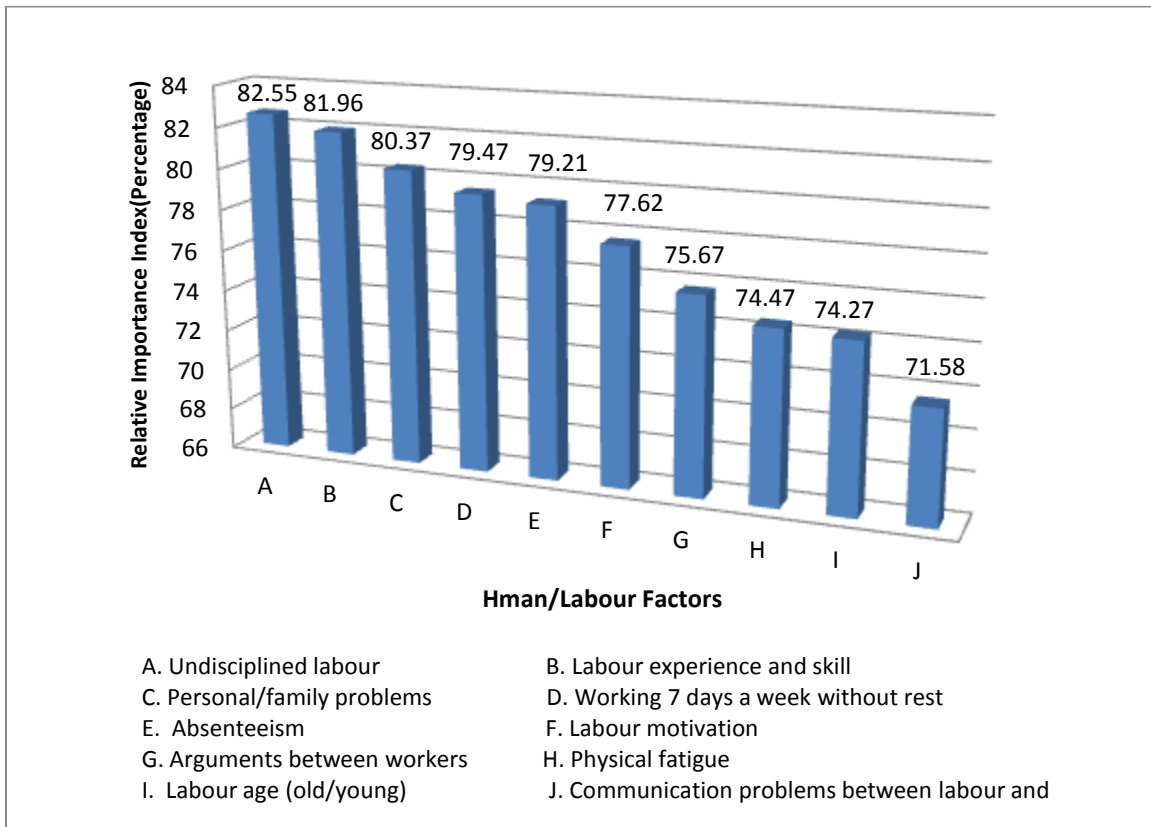


Figure 4- 1 Ranking of Human/labour Factors

Ranked 1st in the group was “Undisciplined labour” with a Relative Importance Index of 82.55% and ranked 4th in overall ranking. The reason behind that this factor has been ranked high is due to the nature of the Egyptian labourers, where they tend to spend time to chat, eat, not doing work properly, or even go away for an unscheduled break. When collecting the questionnaires the majority of the engineers stated that around 25-30% of the labourers on construction projects are undisciplined. Respondents stated that it’s hard to find a quick replacement for a number of undisciplined labourers while being in the middle of the project, since skilled labourers will be already working on other projects. Most of the contractors have their own group of labourers they have been working with on previous projects, and it takes time to get new labourers since it has to be through someone who knows both parties (usually a foreman). They either waste their time walking around, not bothered about completing work, take a few breaks, or even leaving home early. This was not the case in Kuwait and UAE, due to the highly populated foreign labourers, who know that if they are not working properly, this could result in

losing their job, and therefore lose the income which is the main reason for them working in a different country the first place.

‘Labour experience and skill’ was ranked 2nd in the group with a Relative Importance Index of 81.96% and overall ranking 7th between 41 factors. This outcome was further supported by Mahesh (2012) in USA, Durdyeu et al (2011) in New Zealand, Karimi et al (2010) in Afghanistan, Alinatiwe et al (2007) in Uganda, Enhassi et al (2007) in Gaza where it was ranked either the 1st or 2nd important factor that affects labourer productivity. Enhassi et al (2007) stated that the experience of labourers affects the workdone on site. Karimi et al, (2010) also stated that “labourers migrated to other countries after the breakdown of the soviet union” for a better income. The same circumstances are found in Egypt, the majority of the experienced and skilled labourers have travelled to the Gulf countries for a better income, after 2011 and 2013 revolution. Also due to the fact that after the Egyptian revolution many construction projects have either stopped or been terminated due to financial problems. Durdyeu et al (2011) stated that the experience of labourers improves both “the intellectual and physical abilities”, which improves labour productivity. In USA, Mahesh (2012) believes that the main reason why it was ranked 1st was due to the high cost of experienced and skilled labour. Also the employment of experienced and skilled labour is difficult due to the fact that they are engaged on other projects or already have a permanent contractor that they work with. The factor was also ranked 1st in Uganda among 36 other factors were the government is introducing “technical schools in all sub- counties” to improve labour skills, however it will take time for the right skills to be developed. As a result contractors have employed young aged labourers to do work, where they do not have enough experience and skills which causes faulty outputs which results in rework due to the quality of work being below standard. The output is usually rejected either as a whole or in part, by the inspection engineer. The rework then results in more cost and delay to the schedule.

In Egypt, only the “Arab Contractors” have training schemes for workers; while the rest of the contractors rely on the government for training. It is clear from the results obtained that the majority of the labourers do not attend any kind of training, perhaps because they think it is a waste of time since there is no payment in return El-Gohary ,

(2013). In the same time contractors may hesitate to pull their workers off work activities to allocate time for proper training. A recent study by Nasirzadeh et al (2012), has shown that if labourers have regularly training it can result in up to a 42% increase in labour productivity on site.

Personal/Family problems was ranked 3rd in the group with a relative importance index of 80.37% and an overall ranking of 13th between the 41 factors. These findings further corroborate the results obtained by Zakeri et al (2010), where personal/family problems were ranked 3rd out of 10th factors in Iranian construction projects. Zakeri et al (2010) states that “most large and developed projects are located in remote and less developed areas, with poor access and insufficient facilities” . Whilst the majority of the labourers come from rural areas there are not seeing their families for days, plus the economy crises the country is facing, add more pressure to the labourers meeting their families’ needs.

Egypt faced an economic crisis especially after the January 2011 and June 2013 revolutions. Labourers salaries stayed the same while living expenses rose. Family needs increased, from school fees to clothes, private tutor classes, food, and so on. These are all the basics, without including any transportation, medication, higher education expenses and vacation expenses. The labourers think about their family problems everyday, and how they can improve their income for their families, that can assure a better future for their children.

After the 2011 and 2013 revolutions in Egypt, construction projects stopped due to financial problems or due to security reasons. Although the industry was getting back on track at the beginning of 2014, labourers still had family/personal problems that affected their productivity negatively. The majority of the labourers’ families consisted of a wife and either two or three children. During the questionnaire collection the researcher was told by one of the labourers that he was worried that one of his children would get sick, because he did not have enough money to take him/her to the hospital or to buy medicine.

The results obtained in Egypt are different from the results obtained by Ailabouni et al (2012) UAE, Karimi et al (2010) Afghanistan, and Enhassi et al (2007) Gaza. In Afghanistan ‘personal/family’ problems was ranked 10th among 11 Manpower factors and overall ranking of 61 out of 68 factors. It was also ranked 8th between 8 factors in

Manpower and 42 out of 45 in Gaza. Both Karimi et al (2010) and Enhassi et al (2007) agree that personal/family problems is an important factor that affect labour productivity either positively or negatively. Enhassi et al (2007) states that personal/family problems were ranked low in Gaza due to the fact that contractors only think about labour on site and their work. They do not understand that external problems can affect labourers more than factors on site. Karimi et al (2010) goes ahead and explains the personal/family had a low relative importance index due to the fact that the respondents only took into consideration labourers work on the construction project, and that being away from their family can affect their productivity negatively. In UAE Ailabouni, et al (2012) ranked personal/family problems 5th out of 8 in labour group factors and overall ranking of 26 out of 32. He states that 100% of the labourers working the UAE are forginers, where all of them are thousands of miles away from their families. Ailabouni et al (2012) reckons that it was ranked low due to labourers have to be on top of their work, and make sure that tasks given to them are completed on time with quality stated or they will lose their job, and therefore will lose the income they are supporting their families with.

The results obtained in UAE, Gaza, and Afghanistan are also supported by Mahesh (2012) in USA where they were ranked 8th out of 8 factors in manpower group, and 40th and the last between 40 factors that affect labour productivity. Mahesh (2012) explains that was ranked low because personal problems cause mental disturbance for labourers, and thus can affect labour safety more than labour productivity.

Ranked 4th in the group and 15th overall with a relative importance index of 79.47% is assigned to working 7 days a week without rest. The outcome supports the findings reported by Jarkas (2012), Durdyeu et al (2012) and Enhassi et al (2007) among the important factors influencing labour productivity in Kuwait, Turkmenistan, and Gaza. In Gaza working 7 days a week without a rest was ranked 1st in “time factors” group out of 5 factors with a relative importance index of 76.58% and overall ranking of 9th out of 45. Enhassi et al (2007) states that working 7 days a week without rest creates an adverse effect on the motivation and physical strength of labour. This result also agrees with Jarkas (2012) in Kuwait where it was ranked 6th between 24 “management factors” and overall ranking of 17th out of 45. Jarkas (2012) justifies that working 7 days a week

without rest doesn't only cause low productivity, but also leads to a high probability of poor workmanship, rework, and worst, accident on sites.

On the other hand, the results obtained in Afghanistan, India and Thailand were different where they were ranked respectively 25th out of 27th factors in India, 11th out of 23 in Thailand and 52nd out of 68th in Afghanistan. In India the respondents believed that labourers are used to working for a long period of time without days off when engaged on mega projects, since they are working in hard conditions such as weather and with fewer breaks to get a better daily salary.

In Egypt working 7 days a week without rest does have a massive negative effect on labour productivity. Discussions with respondents has shown that making labourers work for a long period of time without rest (3-6 months) causes physical fatigue and definitely decreases their stamina, agility, and motor skills. Such a factor may not be noticeable in the short-term, but it is noticeable in the long-term since it affects project schedule, causes rework since it was not done to the standard required and most important, it affects the trust between contractors, labourers and the project manager.

Furthermore due to the schedule pressure by the government and private sector after the 2013 revolution to get construction projects completed on time, both labourers and construction professionals have been working more than 5 months without any time off, which may lead to a decrease in motivation and morale. Also part of the problem is the labourers themselves, since they ask to work extra days to improve their daily income. The only time they take off during work is 2 hours on Friday to pray, then they continue back again until 3-4 pm. unfortunately contractors know that labourers are in need of the money, so they pay them the same daily wage even on weekends.

As shown in table 4-2 Absenteeism is ranked 5th in the human/labour group and 16th overall with a relative importance index of 79.21%. The findings agree with Mahesh, 2012 (USA), where it was ranked 2nd out of 8 factors in the manpower group and with an overall ranking of 18th out of 40. Mahesh states that these findings can be justified by the nature of the labourers who tend to go to other projects if contractors are willing to pay more or they are either lazy to go to work on a regular basis. The results also agree with Lim et al, 1995 (Singapore) where it was ranked 4th out of 17 human factors and overall

ranking of 12th out of 33 factors. Lim goes ahead and explains that the majority of absenteeism is caused by labourers who do not turn up, where they are either reported on medical leave or just taking a day off.

In Egypt the factor was ranked quite highly by respondents although the construction contractors could hire additional labourers to cover absenteeism it was still according to the respondents a major factor that affects labour productivity negatively. The labourers tend to either find a construction project nearer to their home to spend more time with their family and also save transportation costs. If they also find another contractor who will pay more they will work with them. The researcher's Conversation with the respondents has explained that the majority of the contractors and subcontractors have their own group of labourers that have been working with them on previous projects, but they still face labour absenteeism. The respondents have also mentioned during discussions that some of the absenteeism is due labourers are going to the hospital or staying at home.

The results obtained in this research was further endorsed by Makulsawatudom et al (2004) in Thailand where Absenteeism was ranked 5th among 23 factors. Makulsawatudom et al (2004) explains that craftsmen in Thailand are mostly agriculturists, so they go home to do paddy farming between May to June, and November to December each year. Furthermore, Makulsawatudom et al (2004) explains that another main reason why absenteeism has been ranked highly is because labourers are either drinking or gambling overnight which results in their not waking up in time for work.

The situation in Egypt is different since mostly labourers do not drink alcohol because of their religion (Muslims) and they don't gamble because only foreigners are allowed to have access to casinos in Egypt. The problem is that these labourers do not work on a regular basis with the contractor; they work for a couple of days then they are absent the following day to spend the money they have earned. Two of the project managers have mentioned during discussions that in the calendar there are too many holidays such as Eid Fitr (3 days), Eid Adha (4 days), Prophet Mohamed's Birthday, Sinai Liberation Day, Easter, Christmas, Islamic New Year, 6th October Victory, 23 July Revolution holiday, 25 January Revolution holiday, and 30 June Revolution holiday. These days are usually in

the middle of the week, where labourers tend to take an extra day or two off without informing the contractor in order to have a longer vacation.

4.3 Material Factors

Material factors were ranked second with an average relative importance index of 77.62%.

Factors	Relative Importance Index (%)	Rank
Tools and equipment shortages	85.79%	1
Delay in material delivery on site	83.42%	2
Material shortage	82.37%	3
Low quality of raw material	81.84%	4
Waiting for equipment to arrive	81.78%	5
Damaged material on site	72.93%	6
Inefficient use of material on site	70.36%	7
Increase of material price	62.47%	8

Table 4- 3 Ranking of Material Factors that affect labour productivity

Table 4-3 and figure 4-2 shows the ranking of the factors according to their relative importance index.

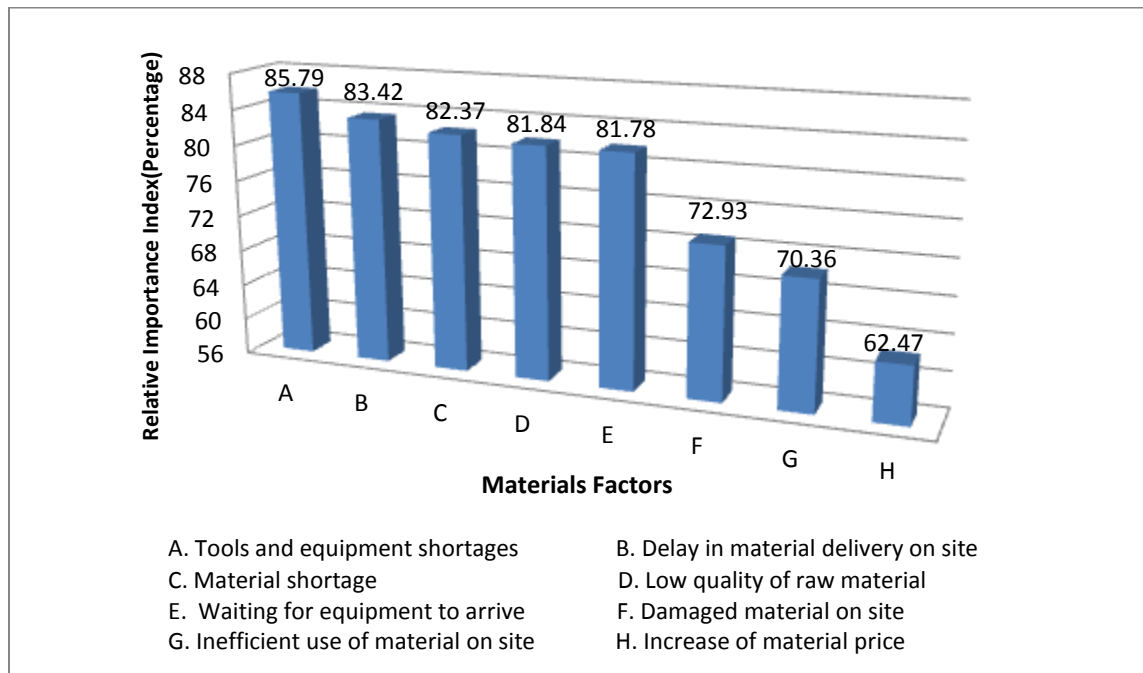


Figure 4- 2 Ranking of Material Factors

With a relative importance index of 85.79% tools and equipment shortages ranked 1st not only in the group but also among the 41 factors. The factor was ranked very highly by respondents, who from discussions have stated that tools and equipment shortages are a major factor that affects labour productivity negatively. The factor was also ranked by Mahesh (2012), Ghoddousi et al (2012), Zakeri, et al (2010), Enhassi et al (2007), Abdul Kadir et al (2005), Makulsawatudom et al (2004) in USA, Iran, Afghanistan, Gaza, Malaysia, and Thailand as a top ranked factor. Some of the major equipments used on sites are cranes, passenger/cargo lift, trailer concrete pump, truck mixer, and safety scaffolding. In USA (Mahesh, 2012) tools and equipment shortage was ranked 2nd between 12 factors in the group and overall ranking 4th among 40 factors. Mahesh (2012) explains that equipment/tool shortage are a key factor for labourers to be able to complete their work. Without them the project will be delayed which results in cost and time overrun. Mahesh (2012) states that any misuse of tools and equipments leads to serious material handling problems as well as slowdown in construction work or even stoppage of tasks. That agrees with Enhassi et al (2007) in Gaza where the factor was ranked 2nd between 3 factors under material/tool group with a relative importance index of 75.26% making it ranked 10th among 45 factors. Enhassi et al (2007) stated that labourers require a minimum number of equipment/tools to complete their work effectively. Any shortage of tools and equipment will result in a decrease in productivity. This factor was also ranked 3rd between 19 factors in the group and 15th overall among 68 factors in Afghanistan. In Iran, Ghoddousi's et al (2012) research indicated that shortage of tools and equipment is one of the top three factors that affect labour productivity in the Iranian construction projects. The factor was ranked 1st in the material group and overall ranking of 3rd among 31 factors. Ghoddousi et al (2012) justified the results that the poor financial strength of the company results in the company unwillingness to purchase proper tools and equipments. Therefore the contractors are unsure of continuing the work, they purchase tools and equipment only when needed. After the 2011 and 2013 revolutions, the contractors have been unsure if the project will continue, so they rent or buy tools and equipment when needed. This results in labourers waiting for tools and equipment to complete work. Beside Orascom Construction Industries, Hassan Allam, Arab Contractors; most of the contractors have been using fairly old equipment and purchasing new equipment is fairly difficult with the financial crisis. From discussions with

respondents showed that some of the problem was due to tools and equipment not kept secure and safe on site which results in damaged equipment or theft. This agrees with Abdul Kadir et al (2005) in Malaysia where shortages of tools and equipment was ranked 4th among 23 factors where he explains it was ranked high due to the ignorance of maintenance programmes leading to inefficient use. The maintenance cost is small when compared with the cost incurred when tools/equipment breakdown. Alinaitwe et al (2007) in Uganda states that casual workers bring some of the working tools (e.g.; hammers, screwdriver, drill etc...) because these workers end up taking the tools they are provided with. Also some of the equipment is not available in some places for hiring. The same situation occurs in Egypt as casual workers need to bring some of their tools with them. Breakdown of major equipment, or shortage of spare parts, improper service, and lack use of machinery all result in shortages of tools and equipments since labourers either have to wait for a replacement, or wait for equipments to be fixed.

Delay to material delivery on site ranked 2nd in the group and overall ranking 2nd among 41 factors with a relative importance index of 83.42%. The findings of this research substantiate the results obtained by Zakeri et al (2010) where it was ranked 3rd amongst 31 factors. Zakeri et al (2010) justify the results by stating that “irregular payments lead to poor procurement and remain a serious obstacle in the path of purchasing material on time” in other words poor procurement planning is the main cause for delay in materials delivery on site. This outcome is further supported by Karimi et al (2010) in Afghanistan where the factor was ranked 2nd between 9 factors in the group and 5th between 19 factors. The factor was ranked quite highly in Afghanistan due to security problems in the country, which causes road closure to some of the construction sites. Another reason is the “lack of adequate infrastructure” that can result in waiting for materials to be delivered on site. Waiting for material is a major factor affecting labour productivity negatively in Egypt, since materials are very important to complete construction tasks, without them the construction process can be on hold. Most of the suppliers have kept their prices the same especially after the revolution to make sure the profit margin is still the same. This then results in long-term discussions between contractors and suppliers to agree the price. Once the price is been agreed the transportation of materials then becomes an issue. Most of the main roads in Cairo are either under maintained or in the process of extension. The government has agreed to do

so due to the number of vehicles that has increased in the last 10 years. The roads are either shut or car accidents delay the transportation of materials. Another reason why this factor was ranked highly in Egypt, is that some suppliers have their storage of material outside Cairo which then takes time to deliver to the construction site in Cairo during rush hours.

On the other hand the results obtained for this factor disagree with the results found in Singapore, UAE, and Uganda. For example in Uganda Alinatiwe et al (2007) state that this factor was ranked 17th out of total 36 factors. Alinatiwe et al (2007) explains that craftsmen have to wait for materials to arrive but since there is a large percentage of labourers are on casual terms and short courses, it can be stated that when there is no material, they can afford to wait without transmitting extra costs to the contractors. In UAE the factor was ranked 9th among 14 factors in the research that was conducted by Ailabouni et al (2012). In UAE the contractors are financially strong and the suppliers have the materials in storage since construction is always ongoing in the UAE. Ailabouni et al (2012) states that it is very rare that labourers have to wait for materials to be delivered to the site. Materials are always on site before labourers arrive to start work in the morning, and there are always stored materials on site. This can't be the case in Egypt as respondents explained that due to security reasons it will be difficult to store a large number of materials on site.

With a relative importance index of 82.37% Material shortage was ranked 3rd in the group and 5th among 41 factors. An example of material shortage can be shortage of cement, bricks, and steel reinforcement which can be a concern as they cause work disruption on site. The results support the findings reported by Soham (2013) Jarkas (2012) Mahesh, (2012) Zakeri et al (2010) Karimi et al (2010) Enhassi et al (2007) Alinatiwe et al (2007) Abdul Kadir et al (2005), Makulsawatudom et al (2004), Kaming et al (1997), and Lim (1995) amongst the top factors affecting labour productivity in India, Kuwait, USA, Iran Afghanistan, Gaza, Uganda, Malaysia, Thailand and Singapore. Material shortage was one of the few factors that was ranked in the top five of all the factors in previous studies as work cannot be resumed without required materials

In Gaza, Enhassi et al (2007) material shortage was ranked 1st in the group and 1st overall between all 45 factors with a relative importance index of 89.47%. Enhassi et al

(2007) justifies the results by stating that in most construction projects that take place in Gaza, the materials have to be imported from Israel, therefore any closure of crossing points between the two countries causes a delay in material delivered which results in shortage of material. In Iran, Zakeri et al (2010) showed that material shortage was ranked 1st among 13 factor and is the most crucial on-site problem. The problem occurs when there is an increase in construction demand due to the reconstruction programme, and that could include power stations, bridges, roads, and factories. Zakeri et al (2010) stated that when materials are delivered too early on the site, it causes double handling, which results in loss of man hours. The results were further supported by Kaming et al (1997) in Indonesia where it was ranked 1st among all factors that affect labour productivity negatively, since materials could cost 50-65% of the construction cost in high buildings in Indonesia. Kaming et al (1997) calculated that the average time wasted for unavailable materials is as follow; steel 2.25 hours, carpenter 3.51 hours and bricklayer 1.69 hours. Another study that supports this finding was in Malaysia, Abdul Kadir et al (2005) found that material shortage was ranked 1st among 50 factors with 64% of the respondents stated that this factor affects labour productivity negatively. The main problem was due to the time preparing to order materials and the time the material actually arrives, which results in labourers waiting for materials. Abdul Kadir et al (2005) mentioned that material shortage is caused by sabotage and negligence. In Thailand, Makulsawatudom et al (2004) research has ranked the factor 1st among 23 factors that affect labour productivity negatively. Makulsawatudom et al (2004) justifies that project managers revealed that this is mainly due to contractor's liquidity problems where many contractor have insufficient finance to procure the necessary materials". The finding also agree with the results obtained in the USA by Mahesh (2012) where material shortage was ranked 1st in the material group and 1st among all factors. Mahesh, (2012) states that poor material management can cause up to 18% work-hour overrun. On the other side the factor wasn't ranked high in Kuwait, where it was ranked 10th out of 24 and 27th overall out of 45 factors by respondents. This is due to the financial strength of local contractors. Also materials are always available by local or by direct imports. It is clear that in UAE and Kuwait material shortage cannot be a major problem because of the suppliers capable of handling material orders.

As stated previously that it is impossible to complete construction tasks without the availability of materials. According to Mahesh (2012) that materials cost 40-60% of the total project cost and are one of the very important factors to complete any construction task. In Egypt the factor was ranked high due to the financial problems the contractors are facing or a shortage in credit facilities which is an issue for material procurement. Another important reason why the factor was ranked high is due to delay of payment from client to contractor which results in contractor delayed in ordering materials. Design/Schedule changes were another reason why the factor ranked high by respondents since design and schedule changes cause different material ordering to complete modified designs. Therefore based on the schedule the contractor orders the materials while the recent government policy after the revolution and the paper work on material procurement has also been causing material shortage, since the procedure takes time to be approved by the government. Discussions with the labourers and engineers shown that some of the main materials such as cement, and sand are delivered to the site loosely by truck. During the delivery process the sand and cement is not securely covered which results in high waste. The cement can be delivered in bag but there isn't proper cement storage on site.

Ranked 4th in the group and overall ranking of 8th among the 41 factors was “low quality of raw material”, with a relative importance index of 81.84%. The results agree with the findings found in Afghanistan by Karimi et al (2010) where it was ranked 1st in the material group and 5th among 68 factors with a relative importance index of 83.75%. Karimi et al (2010) has found that materials delivered are not to the standard specified which delays the construction process since they have to wait for the required and specific materials to arrive on site. The results were different in the USA that was conducted by Mahesh, (2012) where it was ranked 12th between 34 factors. Mahesh, (2012) justifies the findings by stating that material standard is written in the contract between the supplier and contractor, so if the supplier doesn't send the agreed standard, then they pay a penalty. In Gaza, Enhassi et al (2007) supported the finding found by Karimi et al (2010) in Afghanistan where low quality of raw material was ranked 2nd in the group and 18 among 45 factors. Enhassi et al (2007) stated that the time required to build with poor quality material is greater than the time when building with high quality material. In Egypt low quality material is an issue that has been around for a while in the

construction industry. Suppliers either send not specified material or the quality of the material itself is very poor. Some of the suppliers do this to save money, and assume that the required material can be substituted by other standard materials that are cheaper without noticing. Suppliers also change the cement bags with imported cement bags to show a high quality cement is been delivered.

With a Relative Importance Index “waiting for equipment to arrive” was ranked 5th in the group and 9th overall with an relative important index of 81.78%. Examples of equipment can include vibrators, bulldozers, backhoe loaders, cranes, and concrete mixers. Equipments is very important for completely any construction tasks, as labourers cannot work without them. Waiting for equipment can be a serious issue since it can cause delay in daily work and extra cost. With the current situation of the construction industry in Egypt contractors don’t book equipment in advance since they are not sure the project will keep going on it, they rent the equipment when they need it, this process then delays work by making labourers wait for equipment to be arrive on site. The rank of this factor was different than how the factor was ranked in Kuwait and UAE were it was ranked as one of the least important factors that affect labour productivity in construction site. This is due to the stable economy and heavy government investment that allows them to buy them most recent and advanced equipments.

4.4 Management Factors

The management factors group was ranked 3rd with an average relative importance index of 73.65%. The group consisted of 14 factors, where the respondents ranked payment delay as the top factor in the group.

Factors	Relative Importance Index (%)	Rank
Payment delay	82.76%	1
Rework	82.11%	2
Lack of supervision leadership	80.53%	3
Incapability of contractor's site management to organize site activities	79.94%	4
Pick and drop facility	78.68%	5
Late payment from client to contractor	75.79%	6
Design changes	72.63%	7
Unrealistic scheduling	70.46%	8
Offered services for labour (life insurance, medical care,,,,)	69.84%	9
Perks (Eid Bonuses, Free Lunch, School books for children)	69.81%	10
Incentive scheme	69.47%	11
Inspection delay	67.89%	12
Lack of periodic meeting with labour	65.79%	13
Lack of training sessions for labourers	65.53%	14

Table 4- 4 Management factors ranking that affect labour productivity

Table 4-4 and figure 4-3 shows the ranking of all factors with their relative importance index.

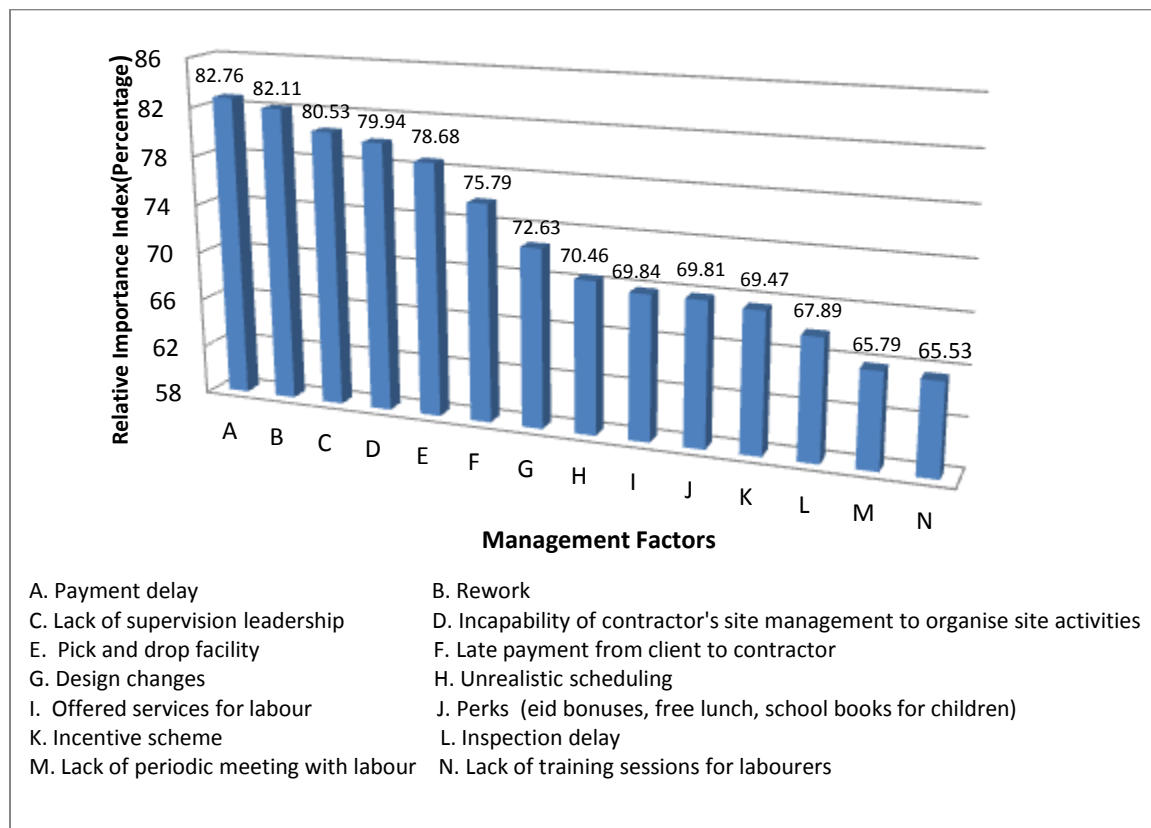


Figure 4- 3 Ranking of Management Factors

Payment delay with a relative importance index of 82.76% was ranked 1st in the group and was further ranked 3rd among all factors explored. The outcome is in agreement with the finding of Karimi et al (2010) in Afghanistan, where it was ranked 2nd in the group and 6th out of overall 68 factors. Payment delays in certain countries like Afghanistan has been an issue since long and difficult payment process cause qualified contractors not to bid for jobs. The process can usually take four-five months depending on the project. In India and Gaza Soham (2013) and Enhassi et al (2007) the factor was ranked 2nd in the management group. The factor was further ranked 6th among 45 factors with a relative importance index of 78.68%. Enhassi et al (2007) justifies the result that payment delay affects labourers mood and “consequently decreases”. As discussion with respondent showed that the problem is not any different in Egypt. Some of the construction projects took up to 8-10 months for payments to go through. Payment is delayed from the client which causes the project to delay progress and increases the cost, since the contractor is stuck where he can’t rent equipments, has labourer wages, need materials etc...). The labourers can’t wait more than a week to get paid since they have family’s needs. Most of the contractors pay from their own pocket to the labourers until they get payed by the

client. When labourers mood decreases, motivation decreases and that results in either decrease in labourer performance or leaving to find another job where they can get paid on a daily basis. Mahesh (2012) states that timeline of payment is important to avoid the risk of late-payment problems. He has found that payment delay was ranked 24th out of 40 factors. The results found in Kuwait by Jarkas (2012) further agree with Mahesh (2012) in the USA. The factor was ranked 29th out of 45 overall factors, and wasn't as important as other factors that affect labour productivity, this is due to the financial strength of the private and public clients, that assure payments in the right time. That is one of the main reasons why 41,000 contractors who were registered with the Egyptian Federation of Construction and Building Contractors (EFCBC) and have decreased to 16,400 due to payment delays or clients are unable to fund projects after the revolution. Payment delay is a risk that effect the project duration and cost which may result in project failure.

Rework with a relative importance index of 82.11% ranked 2nd in the group and 6th among all factors. This effect substantiates the results obtained by Kaming et al (1997) in Indonesia were the factor was ranked 2nd out of 9 factors. Kaming et al (1997) states that bricklayers and carpenters spending almost double the time reworking than steel fixers. This is either caused by design changes, poor instructions, complexity of design specification, and poor workmanship. In Kuwait the factor was ranked 8th in the group among 12 factors and 16th overall among 45 factors. Jarkas (2012) justifies the finding that unrealistic scheduling and working overtime causes rework, which results in cost and time overrun. In Egypt design changes and unclear instruction lead to rework. Beside labourers are working six or seven days a week without rest which causes physical fatigue, and rework. Respondents stated that rework is caused by unclear drawings, supervisor is unaware of job, design complexity, design changes by client and working overtime. The results were further supported by the findings of Enhassi et al (2007) in Gaza and Abdul Kadir et al (2005) in Malaysia were it was ranked 11th out of 45 factors in Gaza and 13th out of 50 factors in Malaysia. Abdul Kadir et al (2005) justifies the results by stating that coordination problem with subcontractor pose a major hindrance to work progress. Example of common problem would be revised construction drawings send to subcontractor cause rework due to construction errors. The ranking of the factor further agrees with the ranking found in Uganda were it was ranked 3rd out of 36 factors

and is one of the main factors affecting labour productivity negatively. In the USA Mahesh (2012) has found the factor to be ranked 4th out of 10 in the group and 19th overall out of 40 factors. The problem in Uganda and USA could be concluded down to unclear specifications and instruction given to labourers, which results in rework. Repetition of instruction daily and daily supervision will result in better understanding by labourers which may help reduce rework. Management people are usually in offices and only go on site when needed, where they should be there every day to check work. Another reason why the factor was ranked high in Egypt is due to the knowledge and skills of the labourers, who is unsure of completing the task. Supervisors and craftsmen have a big role in this factor, since lack of leadership, skills, and knowledge results in incorrect information send to the labourers, where it leads to rework. That agrees with Durdyeu et al (2012) in Turkmenistan where the factor was ranked 5th out of 23 factors. Durdyeu et al (2012) states that rework results in 2-12% of total contract value. Respondents have also stated that contractor and subcontractor employ unskilled labour who have low wages for projects that require experienced and skilled labourers to save money. That then results in rework due labourers can't complete tasks as instructed, contractors then hire experienced and skilled labourers for the job to be completed correctly. The time it takes for rework by the skilled labourer and the time it took by the inexperienced, unskilled labourer has caused the project to be delayed.

The third ranked factor is “lack of supervision leadership” with a relative importance index of 80.53% and overall ranking 12th among the 41 factors. The outcome supports the findings of Jarkas (2012) who stated that lack of supervision encourages operatives especially those who are under the direct employment method to engage in unproductive activities, where supervisors leave the site for personal matters. Another main reason why the factor was ranked highly is due to the experience and skills of the supervisor. When supervisors are unaware of how to complete tasks or give instruction that causes lack of leadership and weak control of labourers. In construction project El-Gohary et al (2013) defined supervision leadership as being able to set direction of project activities, and be able to guide and encourage labourers towards the right direction. Most of the supervisors in Egypt's construction projects are trained but only attend job training and may not be able to do the work as required. They arrive late on site, not attend at all, or leave the site early. Labourers have mentioned while the researcher visited the construction sites that

they don't see the supervisors from time to time, and most of the time they see him only when the project manager is there. Lack of supervision leadership causes all sorts of problems such as rework, labourer attitude problems, problems between workers, and delayed tasks

Ranked 4th in the group and 14th out of 41 factors overall, with a relative importance index of 79.94% is “incapability of contractor site management to organize site activities”. The results agree with the findings in Malaysia by Abdul Kadir et al (2005) where it was ranked 5th out of 50 factors surveyed. Site manager is responsible to ensure that site has been prepared for labourers to be able to accomplish their tasks. They should also check the work sequence according to work programme. Inexperienced site managers in procurement, leadership, scheduling and planning slows down work progress. When site managers cannot organize site activities it causes delay in construction process. Respondents have mentioned that labourers had to be sent home due to site activities haven't been done properly, which decreases motivation and loyalty of labourers.

With a relative importance index of 78.68% ranked 5th in the group and 17th overall was a “pick and drop facility”. As stated previously in chapter 2 that nearly all the construction labourers come from rural cities that are hundreds of KM away from Cairo such as Asyut, Aswan, Qena, Sohag, Minya and Luxor. They are unfamiliar with Cairo city which therefore not sure how to travel to the construction site. Pick and drop facility is an issue since it causes high percentage of labourers absentism. Some contractors send cars to bring labourers to construction site, and class A contractors such “Arab Contractors”, “Orascom Construction Industry”, and “Hassan Allam” have their own buses to pick and drop labourers from a certain place that is close to the construction site and back. On the other side contractors believe that labourers should be able to be at the construction site without any problems. They use transport facilities such as bus, metro, mini-bus, and undergrounds to go to work, which adds additional cost to them. Pick and drop facility will save time since all labourers will start and be at the construction site at right scheduled time.

4.5 External Factors

Ranked last but not least was the External factors with an average relative importance index of 73.10%. The group consisted of 9 different factors can be found in table 4-5 and figure 4-4 with each factor relative importance index

Factors	Relative Importance Index (%)	Rank
On site accident	81.58%	1
Access to site	80.79%	2
Poor site condition	78.38%	3
Shortage of power supply/water	76.42%	4
Weather (high wind, hot temperature, rain and standstorms)	75.00%	5
Security (crime and theft)	71.32%	6
Insufficient lighting	68.91%	7
Regulations change by government	65.26%	8
Natural disaster (flood and hurricane)	60.31 %	9

Table 4- 5 External Factors ranking that affect labour productivity

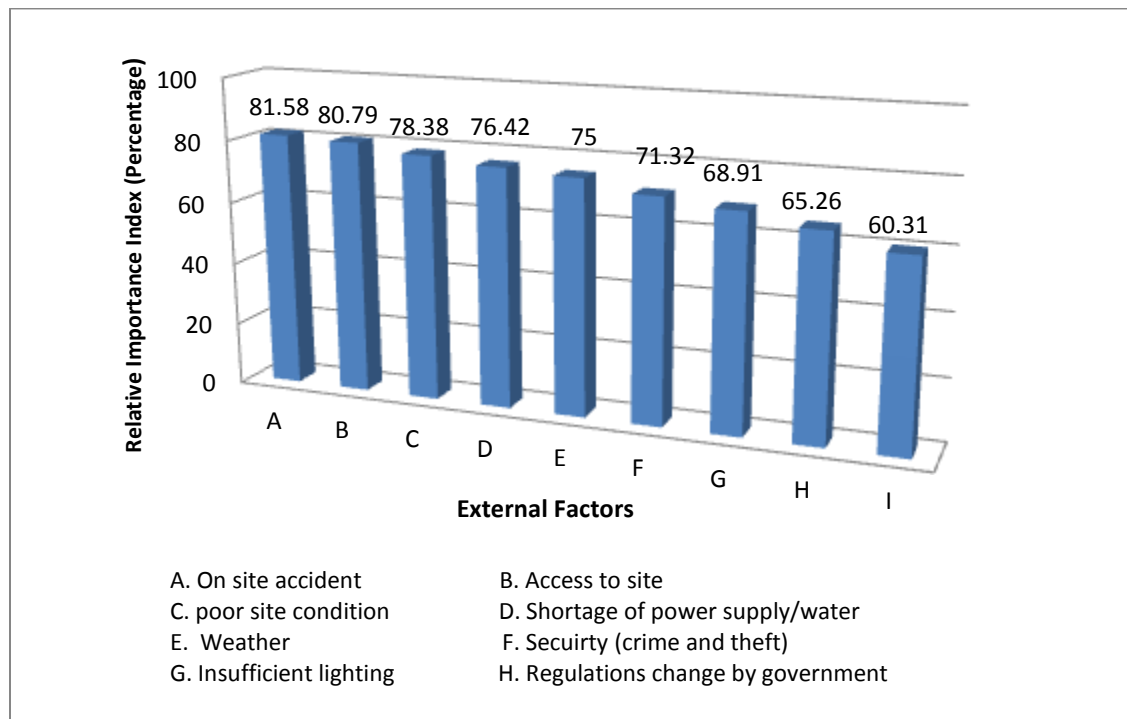


Figure 4- 4 Ranking of External Factors

Ranked 2nd in the group was “on site accidents” with a relative importance index of 81.58% and overall ranking 10th among 41 factors. It is obvious that on site accidents causes delay in the construction project. The results obtained from this research agree with the results obtained in Gaza by Enhassi et al (2007). The factor was ranked 2nd out of 7 in the group and overall ranking 13th out of 45 factors. Enhassi et al (2007) states that there are three types of accidents 1- Accidents that results in death, 2- Accidents that causes injured labourers to be hospitalized for more than 24 hours 3- small accidents that result from nails and steel, wires and affect productivity in few cases. The results further agree with the findings found in USA where it was ranked 2nd in the group and 3rd among all 40 factors. Mahesh, (2012) states that injured labourers causes a decrease in productivity and can result of stoppage of work. In Iran, Zakeri et al (2010) the factor was ranked 8th among 13 factors. In this research there were six deaths recorded on four projects, but not only they caused financial loss to operatives families and to the ministry of labour and social affairs, it also caused a delay to project schedule.

Labourers careless, ignorance, negliance, and lack of attention by contractor causes unsafe working environment, which therefore leads to site accidents. When labourers are injured they delay the work of the rest of the gang. In Egypt it was stated by respondents that nearly every week there is an injured laboure, either a small accidents or big accidents. Most of them cause the work to stop since all labourers gather to see what happened and start chatting. Over confidence in labourers skills has also led to site accidents, where labourers have thought they are aware of all healthy and safety policies on site. They tend to get injured by equipments and tools, or falling from height.

Ranked 2nd in the group is “Access to site” and overall ranking 11th out of 41 factors, with a relative importance index of 80.79%. This effect substantiates the results obtained by Mahesh (2012) in the USA whose research placed “Access to site” in the 11th rank among 40 factors. Mahesh (2012) justifies the findings that poor access reduces the free movement of labour and consequently, reduced labour productivity. Mahesh (2012) also states that “access to site” is one of the common reasons that cause low labour productivity on construction sites. The results were further agreed by Durdyeu et al (2012) in Turkmenistan where it was ranked 4th out of 19 in the group and 17th overall among 68 factors. Durdyeu et al (2012) states drawings are not available in the right time

to indicate where dense areas of labour are working and indicating their route to and from site. The factor was also ranked high in Sri Lanka; Wijekoon (2006) and New Zealand; Durdyeu et al (2011) where it was ranked 4th out of 20 factors in Sri Lanka and 7th out of 56 in New Zealand. Wijekoon (2006) states that access to site is a problem to labourers which is caused by stairways, roads, walkways, and caged work sites.

The majority of the labourers live far away from the construction site. Getting access to site either because of transportation or security reasons can be a key element that affects labour productivity negatively. Another important reason why the factor was ranked high was due to holes and barricades and time spending finding alternative routes. For security reason the majority of the labourers are to provide their ID before entering the site.

Poor site condition is ranked 3rd with a relative importance index of 78.38% and ranked overall 18th among 41 factors. Poor site condition can be land height, shape and ground conditions. Some examples of different site conditions occur when a contractor performs earth excavation and different soil types that weren't previously seen. Each site is different than another and poor site condition can cause difficulties and unsafe working environment, which can result in accidents and delay. Most of the site conditions are outside the hands of the project managers control but contractors should take care of it before the start of the project, which can cost the contractor extra money. The factor wasn't ranked high in Malaysia (38th/50), Thailand (19th/23), and Uganda (22nd/36). On the other side the factor was ranked 4th out of 12 in the group and overall 6th out of 40 in USA by Mahesh (2012). Mahesh (2012) states that differing site or unpredicted conditions occur when underlying site conditions for a construction project are uncovered after the contract between the contractor and the owner has been executed and were not previously expected or included in the design document.

With a relative importance index of 76.42% "shortage of power supply/water" ranks 5th in the group and 20th overall. One of the main contributors to large productivity gap between developed and developing countries is low quality infrastructure. Power supplies in many African countries have the reputation for high distribution costs, and unreliability, that affects efficiency and competitiveness (Abdul Kadir et al, 2005). After the revolution shortage of electricity has been an issue, since the country is unable to

provide electricity to all places due to bombing to major power stations. Water has also been an issue since its either not to be used for drinking at some places or isn't available. Most of these problems are out of the contractors hands. If power and water are available there might be also other problems such as underground power cables are stuck by excavators, and water pipes are burst during excavation work. Another cause of power disruption is the damage of supply lines during the relocation process. The results agree with the findings in USA by Mahesh (2012) where the factor was ranked 1st out of 12 in the group and 2nd overall between 40 factors. Mahesh (2012) states that proper lighting is one of the basic requirements for obtaining fair labour productivity with any construction work, failure to have adequate lighting may lead to different consequences, such as misplacing a particular job, or even a serious accidents and deaths. The findings in Uganda and Singapore were different than Egypt, since the factor was ranked 20th out of 36 overall factors (Uganda) and 10th out of 17 (Singapore).

The fifth ranked factor was “weather (high wind, hot temperature, rain and standstorm”) with a relative importance index of 75.00% and ranked 23rd overall. The majority of the construction work is done in open atmosphere and can be seriously effected by unexpected weather conditions. To understand why the factor was ranked highly by respondents a closer look to Egypt's climate was looked at. Most of the African countries are hot and dry. In Egypt the temperature averages between 26.7°C and 32.2 °C in the summer and up to 43°C on the red cost. In winter the temperature varies on an average between 13°C and 21°C. In general the weather in Egypt is hot and dry and humid in the delta along the middertanan cost. Humidity increases in July and August and spreads through all Cairo.

In Gaza the factor was ranked 29th among total of 45 factors. Enhassi et al (2007) states that winter weather such as wind and rain reduces labour productivity, especially external work such as steel work, concrete casting, external plastering, external painting, and external tiling, hence weather can stop work totally. The results were further agreed by Alinatiwe et al (2007) where it was ranked 10th out of 36 factors, where rain in Uganda is heavy but lasts for a short period of time. They cause damage to unprotected buildings components under construction that are mainly carried on site. The majority of North Africa and the Middle East are hot and dry with an average temperature between 29°C-

35°C where labourers are used to working in such conditions but get tired quickly and need breaks for water and food. In the USA weather conditions was ranked 7th out of 40 factors. Mahesh (2012) states that performing work below 10°F and above 110°F is generally difficult since it affects labour performance. Almost 30% of the productivity loss is for steel erection construction occurred due to winter climate.

In UAE, Ailabouni et al (2012) found that weather condition affects labour productivity negatively. The temperature in UAE goes up to 42-45 °C and a relative humidity varying from 40-90 and some cases 95%. The government makes a mandatory break for all construction workers between 12;30-3;30pm from the period of June to September to assure the safety of the workers. The same case was found in UAE's neighbor Kuwait. Where findings in Kuwait done by Jarkas(102) has ranked the factor 11th overall out of 45 factors. The temperature in Kuwait can reach up to 50 °C between the periods of June- August where the government then bans work in open environment between 12;00 -16;00. The rest of the months are normally pleasant with mild temperatures ranging from low 20 °C to low 30 °C.

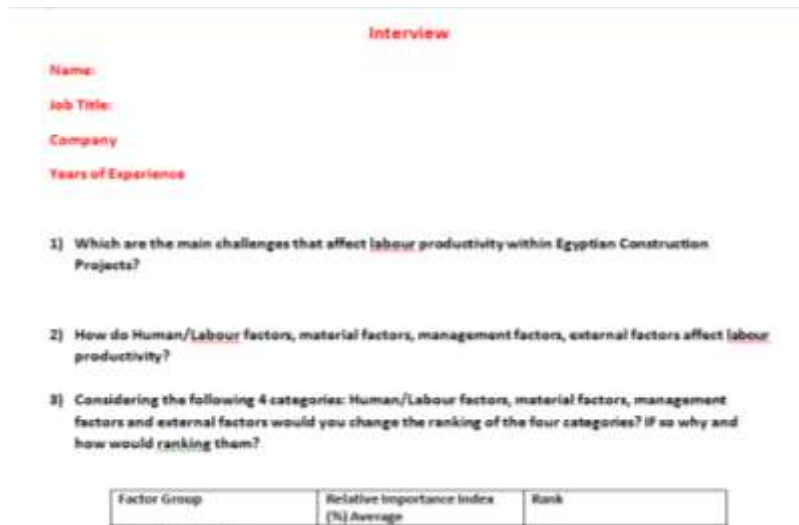
100% productivity can be reached when the temperature is between 5 °C and 25 °C and a relative humidity is below 80% Zakeri et al (2010). Since weather cannot be controlled by contractors, contractors can overcome the problems by pre fabricating some of the work. The contractors also need to keep in mind "Ramadan" (The Holy month for Muslims) where 90% of the labourers are fasting from 5;00am until 6;00pm the next day. During the whole month work slows down and labour performance is slowed down due to increase in temperature and no water or food. Usually contractors start work early before the temperature reaches it daily peak, and finishes work early.

Factors	Relative Importance Index (%)	Rank	Factor Group
Tools and equipment shortages	85.79%	1	Material
Delay in material delivery on site	83.42%	2	Material
Payment delay	82.76%	3	Management
Undisciplined labour	82.55%	4	Human/Labour
Material shortage	82.37%	5	Material
Rework	82.11%	6	Management
Labour experience and skill	81.96%	7	Human/Labour
Low quality of raw material	81.84%	8	Material
Waiting for equipment to arrive	81.78%	9	Material
On site accident	81.58%	10	External
Access to site	80.79%	11	External
Lack of supervision leadership	80.53%	12	Management
Personal/family problems	80.37%	13	Human/Labour
Incapability of contractor's site management to organize site activities	79.94%	14	Management
Working 7 days a week without rest	79.47%	15	Human/Labour
Absenteeism	79.21%	16	Human/Labour
Pick and drop facility	78.68%	17	Management
Poor site condition	78.38%	18	External
Labour motivation	77.62%	19	Human/Labour
Shortage of power supply/water	76.42%	20	External
Late payment from client to contractor	75.79%	21	Management
Arguments between workers	75.67%	22	Human/Labour
Weather (high wind, hot temperature, rain and standstorms)	75.00%	23	External
Physical fatigue	74.47%	24	Human/Labour
Labour age (old/young)	74.27%	25	Human/Labour
Damaged material on site	72.93%	26	Material
Design changes	72.63%	27	Management
Communication problems between labour and supervisor	71.58%	28	Human/Labour
Security (crime and theft)	71.32%	29	External
Unrealistic scheduling	70.46%	30	Management
Inefficient use of material on site	70.36%	31	Material
Offered services for labour (life insurance, medical care,,,))	69.84%	32	Management
Perks (Eid Bonuses, Free Lunch, School books for children)	69.81%	33	Management
Incentive scheme	68.95%	34	Management
Insufficient lighting	68.91%	35	External
Inspection delay	67.89%	36	Management
Lack of periodic meeting with labour	65.79%	37	Management
Lack of training sessions for labourers	65.53%	38	Management
Regulations change by government	65.26%	39	External
Increase of material price	62.47%	40	Material
Natural disaster (flood and hurricane)	60.31%	41	External

Table 4- 6 Overall Ranking of all factors that affecting labour productivity in Egyptian Construction Projects

4.6 Interview Findings and Analysis

Six Interviews were done with experienced professionals (20+ years) in the Egyptian construction industry that will help understand the issue and how it can be managed from their point of view. The interviews data will be used to gain a better understanding of the issue, and possible ways of managing and improving labour productivity. During the interviews the professionals were given the findings of the questionnaire that shows the overall ranking of factors affecting labour productivity in the Egyptian construction projects (Table 4-6) and the group ranking (Table 4-1) to comment on. The interview consisted of five questions since the researcher didn't want to take too much of the professionals' time. A snapshot of the interview can be found in figure 4-1 while the whole questionnaire can be found in Appendix C



The image shows a screenshot of an interview form titled "Interview" in red. It contains four red labels: "Name:", "Job Title:", "Company", and "Years of Experience". Below these are three numbered questions in black text. At the bottom, there is a table with three columns: "Factor Group", "Relative Importance Index (%) Average", and "Rank".

Interview

Name:

Job Title:

Company

Years of Experience

1) Which are the main challenges that affect labour productivity within Egyptian Construction Projects?

2) How do Human/Labour factors, material factors, management factors, external factors affect labour productivity?

3) Considering the following 4 categories: Human/Labour factors, material factors, management factors and external factors would you change the ranking of the four categories? If so why and how would ranking them?

Factor Group	Relative Importance Index (%) Average	Rank
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Figure 4- 5 Snapshot of Interview questions

By applying the content analysis technique on the feedback received from the subjects, the researcher compared the factors affecting labour productivity in the Egyptian Construction projects and an understanding of how to manage the factors. In particular:

Management factors: All the interviewees stated management factors has a great impact on labour performance. In particular interviewees stated that improving management factors will improve labour performance on site. Furthermore interviewees stated that management factors include but not limited to payment delay, incentive schemes, regular training, planning and work flow, sub- contractor management, and lack of supervision

have direct affect on labourers moral and loyalty. It can be said that five out the six interviews have ranked management factors as the number one group affecting labourers productivity due to its importance it has. In addition interviewee C has stated that “yes material factors are extremely important and any shortage of materials and equipments causes a delay in work or could even stop work completely, but in my opinion after 30 years in construction projects management factors has a bigger influence on labourers productivity”. For example payment delay (management factor) affect personal and family problems, where workers need their daily wages for family’s need. In particular interview D has stated that lack of supervision leadership should been ranked in the top 5 factors overall. Since lack of supervision can lead to indiscipline labour, and wrong information delivered which results in rework.

Based on the findings of the questionnaire and the interviews, the researcher finds a difference in the importance of the factor group. Management factors was ranked 3rd between all 4 groups with average relative importance index of 73.65% (3.97% less than material factors and 4.08% less than human/labour factors). This is due to questionnaire respondents believed that Human/Labour factors and materials factors have immediate effect on labour productivity such as absenteeism, indiscipline labour, shortage of materials and equipments. On the other side interviewees believed that management factors has long-term and short-term affect on labour productivity such as payment delay and late payment from client to contractor which cause disloyalty for labourers and may result in them looking for jobs somewhere else. While inspection delay and lack of training sessions will affect labour productivity but on the long-term since it will take time to see the effect of these factors on labourers productivity. The findings of the interviews such as payment delay, rework, and lack of supervision leadership were ranked as top ranked factors in Enhassi et al, (2007); Soekiman et al, (2009); Mahesh, (2012), and Jarkas, (2012). For example Enhassi et al, (2007) stated that payment delay affect labourers mood and “consequently decreases”. Incentive schemes was ranked 11th in the management group with a relative importance index of 69.47% and overall 34th overall according to the questionnaire findings. The researcher believes that this due to questionnaire respondents believed other factors have an immediate effect on labour productivity. Incentive scheme was one of the six factors the interviewees believed that it’s an important factor that affects labour productivity. The interviewees findings agree

with previous research conducted by (Lim, 1995; Makulsawatudom et al, 2004; Wijekoon, 2006; Olasbosipo, 2011) where incentive schemes were ranked in the top 5 factors that affect labour productivity. The researcher justifies this by saying incentive schemes can improve labour motivation, moral, and loyalty if done correctly. Looking at previous studies the author finds that lack of supervision leadership was ranked in previous research but was ranked 12th by Jarkas, (2012), but interviewees believed that lack of supervision leadership can cause rework, indiscipline labour, wrong information delivered, delay in schedule due to supervision unaware of tasks.

Management factors group was the most group that had factors assigned to. It contained 14 factors where 6 out of these 14 had a relative importance index of more than 75% which indicated the importance of the factors. On the other side factors such as “lack of periodic meetings, inspection delay, and lack of training session for labourers had a low relative importance index percentage which resulted in an affect of the total relative importance index average and therefore ranked the group 3rd out 4 groups. Figure 4-2 gives a summary of the interviews and what are the main management factors that affect labour productivity from the interviewee’s point of view

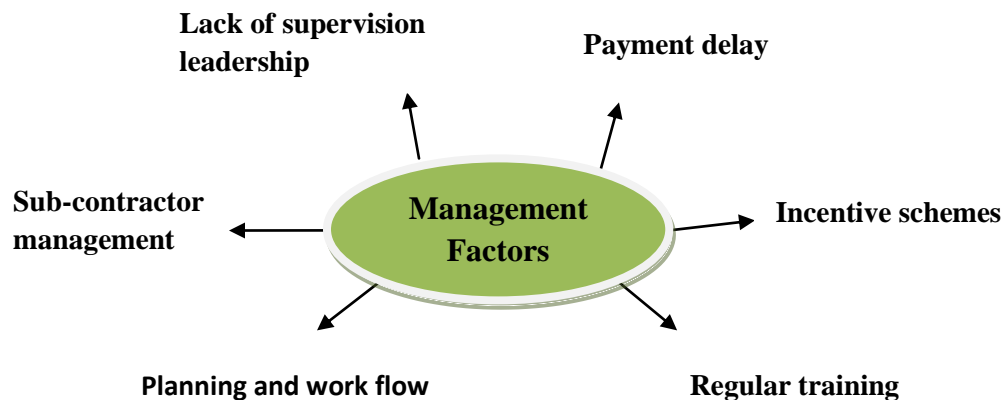


Figure 4- 6 Summary of interviews findings for management factors

Challenges that affect labour productivity: It is clear that during the interviews that there are several challenges that affect labour productivity in the Egyptian Construction Projects. In particular interviewees have stated examples such as poor payment rates, very hot weather, lack of adequate awareness of the importance of health and safety issues, lack of skill due poor technical education, apprentice programme/experience and

training. Interview B stated that a good way to improve labour motivation and loyalty is by having a regular monthly meeting with all site labourers and discuss what issues they have on site and see it can be improved or managed in a better way. Interview C and D stated that most of the accidents on site are caused by labourers since they are unaware of any health and safety rules which results in increased numbers of injuries and deaths. It was also clear during the interviews that lack of social and medical insurance umbrella especially for daily based labourers was an issue. Wages was another challenge to labourers since everything got more expensive (transportation, medication, food, school fees etc...) and the wages are still the same, therefore labourers are unable to meet family needs. Furthermore interview B stated that “transportation from and to site was an issue where labourers either arrive late to site, or sometimes results in absenteeism. The findings of the interviewee are understandable since the questionnaire results support this. For example the author finds that lack of skills and experience was ranked 7th overall among 41 factors and 2nd in the human/labour group. The factor was also ranked either 1st or 2nd in previous research that was conducted by: Mahesh, (2012); Durdyeu et al, (2011); Karimi et al, (2010); Alinatiwe et al, (2007), Enhassi, (2007). When there is lack of skills and experience tasks are either done incorrectly which results in rework or there isn't the right person to do the job. In particular interview D stated that only skilled labourers should be assigned to skilled jobs, this will reduce time (no rework) and done correctly from the first time (on schedule). Figure 4-3 summarizes the findings of the interviews of the challenges that affect labour performance

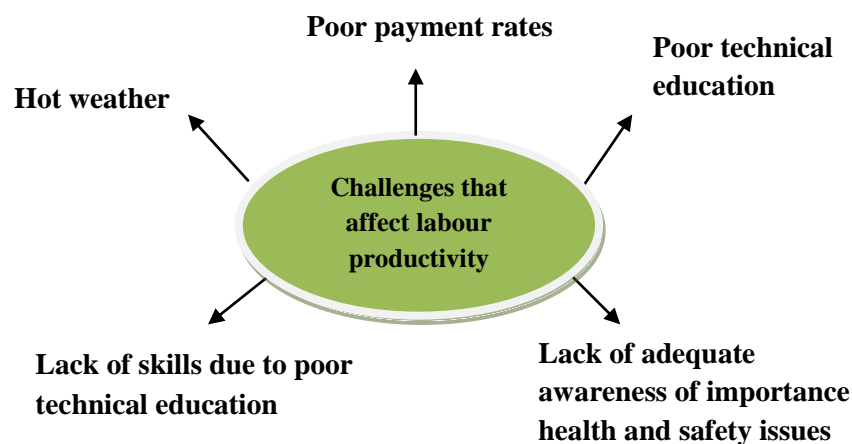


Figure 4- 7 Summary of the challenges that affect labour productivity from interviews point of view

Government role to improve labour productivity: Another theme the researcher has noticed during the interviews was the key role the government plays in labour productivity on construction sites. All interviewees have agreed that government has to give more attention to secondary education and technical education, which hasn't been to standard and not up dated for years. Hence this results in lack of skills and knowledge. The government depends on the labourers learning through experience or from experienced workers. This also results in rework since labourers aren't sure of completing the tasks properly. In particular Interview A and C stated that time spend by labourers unproductive can be reduced if quality and quantity of technical education is improved. In addition the government the government should provide medical insurance, perks, and new pension rates that can bring skilled and experienced labourers home. When labourers are treated properly by the government and feel the government will look after him and his family there is a greater chance they will stay and work in Egypt, especially that the rest of their relatives live in Egypt and they would like to be next to them. Furthermore interview C and D stated that the government should change the long process of document process that delays most of the start of any project. Improving the legal document system in Egyptian Construction projects and making sure it is signed off in time will remove a lot of the pressure the contractor faces.

When looking at the questionnaire findings, the author can state that out of the first 20 factors a minimum of five factors the government plays a role in, such as: personal/family problems, shortage of power supply/water, on-site accidents, low quality of row material, and access to site. Some of these factors the government can have an effect on, and other they can improve. For example when wages are not high and labourers have to manage and get school fees, private tutoring fees, accommodation rent, clothes, medication, and food that increase family and personal problems, which then results in low labour productivity because they aren't thinking about the work they are doing and instead thinking of family problems. By improving transportation facilities such as public buses, and making sure they go to different parts of Cairo with a reasonable ticket price, will make labourers save money and reduce absenteeism. The government has a big role in the construction projects first it needs to apply enough power supply/water for projects to stay in progress without any delay. Interview A and B stated that medical insurance

should be done for any labourer working on a construction site, while school fees need to be reduced for anyone who is on minimum wages.

A summary of the interview findings of the government role to improve labour productivity from the interviewee's point of view can be found in figure 4-4

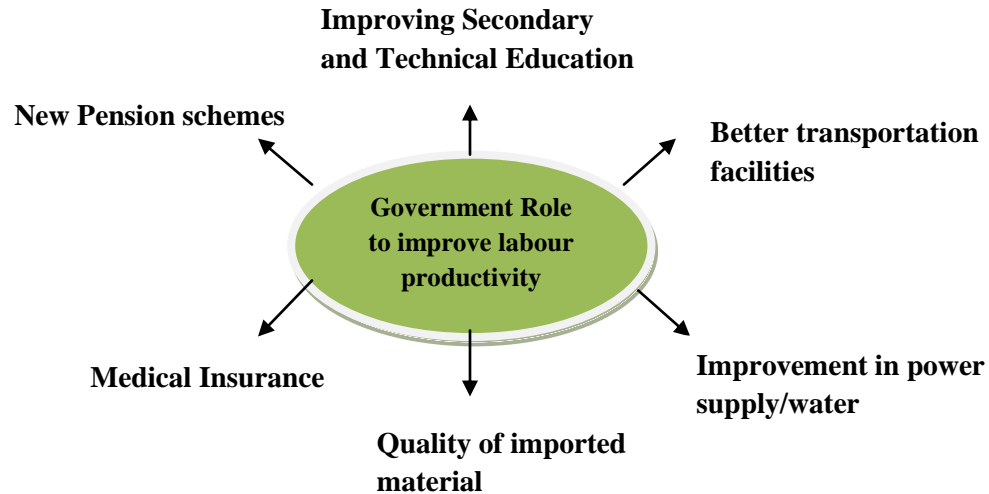


Figure 4- 8 Summary of interview findings on how the government may help improve labour productivity

Looking at previous studies conducted by (Kaming et al, 1997; Karimi et al, 2010; Abdul Kadir et al, 2010; Durdyeu et al, 2012) the author finds that the government has an important role in improving labour productivity, which agrees with the findings of the interviews. For example Kaming et al, 1997 stated that education system in Indonesia has a big impact on labourers since they don't learn much in their secondary education or technical education. Karimi et al, (2010) states that well planned education system by the government doesn't mean that labourers can do all tasks, but they will have the knowledge and skills that they can build on in the future. All four researchers (Kaming et al, 1997; Karimi et al, 2010; Abdul Kadir et al, 2010; Durdyeu et al, 2012) believed that government role in medical insurance for daily workers is very important, since it will remove pressure on the workers that they have to pay for it, and second workers will feel comfortable that in case they get injured they can get medication without extra cost.

It is clear to the researcher that throughout the interviews management factors was a key group that affect labour productivity on the long-term and short-term. All interviewees have stated that the government has several duties for improving labour productivity on site. Some of these duties can take time before results can be seen, (For example improving technical education), but they have to be in the government near plans.

Challenges to labourers will not end, and most of them can't be eliminated, but for sure can be managed in a different way. For example improving medical insurance, labourers rights, no labourers are allowed to get payed less than minimum wages. It is very important that the government discuss possible solutions with contractors for a better project performance.

4.7 Chapter Summary

The chapter has analyzed the data gathered from the questionnaires and the interviews. The finding of the questionnaires has shown that the top ranked factor group is Human/Labour factor, followed by material factors, management factors, and external factors. The author discusses in the chapter why the groups had a close relative importance index. The findings of the interviews showed that management factors are the main factors that affect labour productivity on construction sites from the interviewee's point of view. Interviews also showed the government role in improving labour productivity and the challenges labourers faces. The author analyzed the findings of the questionnaires and interviews by comparing the results with previous studies discussed in the literature and justifies why certain factors were either ranked low or high in Egypt compared to previous studies. Next chapter the author will conclude and explain how the research aim/objectives have been met. The author then provides recommendations for future work.

5.0 Conclusion and Recommendations

5.1 Introduction

Construction tasks are expensive and low labour productivity results in more cost and time to any construction project. In most recent years the construction industry has been facing decrease in productivity. In particular decrease in labour productivity on construction sites. Egyptian Construction Industry is a key player in Egypt's economy and employment rate. Due to the problems the industry is facing after both 2011 and 2013 revolution it was important to study the factors that affect labour productivity on construction sites, and recommend possible ways to manage such factors. The following sections explain how the researcher hypothesis "the researcher is of the belief that labour productivity in the Egyptian Construction Industry is affected by a number of factors that these need to be investigated" was correct.

5.2 Overview of research aim and objectives

The research attempted to identify the factors contributing to the decline in labourer's productivity in the Egypt Construction Industry. In particular the research investigated what are the top factors that affect labour productivity and analyzed the results based on previous studies.

The research aimed at achieving several objectives. The first objective the researcher tried to accomplish was to understand productivity challenges to construction labourers, through an intensive literature review that gave definitions of productivity, productivity in construction and different factors that affect labour productivity based on previous research done. The second objective was to understand the Egyptian Construction Projects and the challenges the industry is facing especially after 2011 and 2013 revolution. The researcher has then provided a list of factors a list of factors that he thinks might affect labour productivity in Egyptian construction project based on the literature review. A draft of the questionnaire went through a pilot study for amendments before being distributed to construction professionals to rank the importance of the factors. The final objective was to propose key strategies drivers that will enhance labour productivity.

5.3 Achievement of the research

The research managed in fulfilling the set-out objectives. The study carried out a literature review on what is productivity and the different factors that affect labour productivity in developed and developing countries. The literature also gave an overview of the Egyptian construction industry and challenges it's facing.

A total of 41 factors were identified based on the literature review and was distributed to construction professionals as a questionnaire to fill. A total of 258 hard copy questionnaires were handed out and 227 were collected back (87.98% response rate). The factors were then ranked based on their relative importance index. Based on the questionnaire findings the top ten factors were:

- Tools and equipment shortages
- Delay in material delivery on site
- Payment delay
- Undisciplined labour
- Material shortage
- Rework
- Labour expensive and skills
- Low quality of raw material
- Waiting for equipment to arrive
- On-site accident

The study also conducted six interviews with experienced (20+years) construction project managers to compare its findings with the questionnaires. The interviews showed that management factors group was an important group that has a high influence on labour performance. During the interviews possible ways of managing the top factors were given. A comparison of the interviews findings was also done with previous research to see a link why some factors were either ranked high, medium, or low importance. It can clearly be stated that the government has an important role in reducing such factors and needs to have a clear plan to overcome such problems

5.4 Recommended Key Strategic Drivers

From these findings the researcher goes ahead and recommends ways of improving and reducing the factor that affect labour productivity, the are :

- Investment in people is very valuable especially in a country like Egypt with a relatively high population and an abundance of manpower. Government policy should pay attention to secondary technical education and apprentice programs.
- Government need to provide rules and regulation which will help create a safe working environment for labourers such as obliging companies to provide minimum wages and insurance coverage against accident during work. This can be agreed with the “Egyptian Trade Union Federation” to make sure the labourers are under the umbrella of working in safe environment. Government could also provide industry wide seminars and workshops that promote Health and Safety issues. In this way accidents on site will reduce due to the labourers are more familiar with the Health and Safety regulations.
- Contractors should support labourers for regular training and for the craftsmen to keep them up to date and aware of skills which has to be improved.
- Improve labour motivation by paying them a fair wage that they and their families can live from with the cost is increasing. That could be done by developing a Incentive scheme programs were workers will know that tasks completed on-time with the standard required will result in bonuses and will also increase labourer’s loyalty and moral of labourers. This can also be done by developing good work schedules that respect workers home needs both local to area and external to area. This means provide balance between safe site and happy life.
- Stakeholder should adopt collaborative construction procurement approaches such as Design and Build Alliances. This would enhance the constructability of the design thus facilitate the production process, enhance communication and coordination between project parties in which turn enhances the flow of activities.

- Enhancing the constructability of design drawings and make sure they are given in advance to be checked. By checking the design drawings in advance will allow time to order material and equipment hence resulting in reducing the time waiting for equipment and materials to arrive. It will also allow any necessary drawings to be done in time without any delays.
- Contractors should establish long-term relationships with manufactures and suppliers to develop methods of delivery to avoid inventory and delays. A detailed schedule of material supply should be provided by the contractor. The schedule should contain the time required for material to arrive on site. This results in reducing unproductive time on site and cost saving.
- Purchased material should be stored at a safe appropriate location at site to protect it from damage, while providing security during night. Storing materials would result in work starting the next day immediately without waiting for material replacements.
- A friendly relationship should be between project managers, contractors and labourers. When labourers are treated well and respected they give 100% of work effort and take care of the tools and equipments as if it's their own.
- Establish regular meeting between amongst project participants with all different levels This will increase the level of trust and encourages workers to work together. This will also assist manager in minimizing the lack of professtional management skills such as slowness in making decision.
- Accommodation and transportation should be provided to labourers to make sure labourers are on site to start work in the morning. Place a camp site to reduce travel time
- Absenteeism can be reduced by giving paid time off and vacations. No labourers are allowed to work more than 5-6 days a week under any circumstance. A tired worker is

not productive or safe. A periodic monthly awards for full attendance by workers can be a key to reduce absenteeism

- Advanced equipment planning, all equipment should be working or new, labourers shouldn't wait for equipment to be repaired. The government need to import advanced technology equipment that could be rented by contractors with reasonable price. As well as Use new technologies such as scheduling softwares and more efficient equipment can yield an immediate return on investment in increased productivity
- Various external factors and nature factors should be considered in the budget estimation and schedule to minimize delay, for example Ramadan, and extreme hot and dry weather in the summer.
- Only hire skilled workers for jobs that require skills this will then reduce rework
- Appoint a Quality Assurance (QA), Quality Control (QC) representative on site to watch for any errors and could quickly provide solutions. Risk assessment should also be completed on project before each project phase to identify any potential risks that may cause delay or project failure.

5.5 Recommendations for Future Work

The researcher had limited access to construction sites and firms where he only had permission to visit either the construction sites or the offices for two days only. One day to hand-out the questionnaires and explain anything respondents are not sure of, while the second day was to collect the questionnaires. Due to time restrictions the researcher has only managed to collect the research data in Cairo where samples from other cities such as Alexandria and Sharm-El Shiekh would give a more accurate data. The researcher has only considered construction professionals either for the questionnaires or interviews where he believes if he had more time he would have conducted interviews with labourers, craftsmen, and academics to get their point of view of the problem. In addition interviews with clients will give more depth to the collected data.

In order to complete this research a few recommendations for future work are suggested:

- A different questionnaire could be provided to labourers with a different list of factors, where they can rank them.
- A comparison between the construction professionals questionnaire findings and labourers questionnaires findings were discussion can be done to analyze the differences between the two.
- Interviews with government decision makers will provide a concrete understanding of what the government is doing to manage the problem and future plans for improving labour productivity
- Interviews with labourers and craftsmen to understand the challenges that they face and how it can be improved.
- Taking a different sample size other than the top three class ranked by EFCBC (Egyptian Federation of Construction and Building Contractors) to see if the factors affecting labour productivity are different from the top ranked contractors.
- A focus group could be formed to validate the results of qualitative and quantitative data which can be used to provide a labour productivity model.

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Appendix A English Questionnaire

Questionnaire Survey

Name:

Job Title:

Year of Experience:

Company Name:

Date:

If you may please tick the box by (✓) for the answer the most suits the "factors affecting labourers productivity in Egypt Construction Projects

Note: Answer "1" mean Strongly not important, "2" mean Not important, "3" mean Neutral, "4" mean Important, "5" mean Very important

Num	Factors Affecting Labour Productivity	Degree of Importance					Comments
		1	2	3	4	5	
	Human/Labour Factors						
1	Indiscipline labour						
2	Physical fatigue						
3	Personal/family problems						
4	Arguments between workers						
5	Working 7 days a week without rest						
6	Labour experience and skill						
7	Labour age (old/young)						
8	Labour motivation						
9	Absenteeism						
10	Communication problems between labour and supervisor						
	Management factors	1	2	3	4	5	
11	Pick and drop facility						
12	Payment delay						
13	Lack of supervision leadership						
14	Incentive scheme						
15	Late payment from client to contractor						
16	Lack of training sessions for labourers						
17	Offered services for labour (life insurance, medical care,,,,)						
18	Incapability of contractor's site management to organize site activities						
19	Rework						
20	Inspection delay						
21	Unrealistic scheduling						
22	Perks (Eid Bonuses, Free Lunch, School books for children)						
23	Design changes						
24	Lack of periodic meeting with labour						

Num	Factors Affecting Labour Productivity	Degree of Importance					Comments
		1	2	3	4	5	
	External Factors						
25	Poor site condition						
26	On site accident						
27	Weather (high wind, hot temperature, rain and standstorms)						
28	Regulations change by government						
29	Shortage of power supply/water						
30	Access to site						
31	Natural disaster (flood and hurricane)						
32	Insufficient lighting						
33	Security (crime and theft)						
	Material Factors	1	2	3	4	5	
34	Delay in material delivery on site						
35	Tools and equipment shortages						
36	Low quality of raw material						
37	Increase of material price						
38	Damaged material on site						
39	Waiting for equipment to arrive						
40	Material shortage						
41	Inefficiency material on site						

Appendix B Arabic Questionnaire

استقصاء رأي

الاسم:
الوظيفة:

عدد سنوات الخبرة:

الشركة:
التاريخ:

الرجاء من سيادتكم بأن تفضلوا بوضع علامة (✓) على الاجابة الانسب للأسئلة التالية الخاصة بالعوامل المؤثرة على إنتاجية العمالة في صناعة التشييد المصرية
ملاحظات: الاجابة "1" تعني تأثير ضعيف جدا و الاجابة "2" تعني تأثير ضعيف, الاجابة "3" تعني تأثير متوسط, الاجابة "4" تعني تأثير قوي ,
الاجابة "5" تأثير قوي جدا

رقم	العوامل المؤثرة على انتاجية العمالة	درجة التأثير					ملاحظات
	عوامل تتعلق بالعامل نفسه	1	2	3	4	5	
1	عدم الضباط العمالة						
2	الارهاق الجسدي						
3	المشاكل الشخصية والعائلية						
4	الجدل بين العمال						
5	العمل 7 ايام اسبوعيا بدون راحة						
6	خبرات ومهارات العمال						
7	عمر العامل (كثير في سن/صغير في سن)						
8	الحوافز العمالية						
9	التغيب عن العمل						
10	مشاكل التعامل بين العمال والمراقبين						
	عوامل تتعلق بالادارة	1	2	3	4	5	
11	سهولة نقل العامل الى مكان العمل						
12	تأخر دفع الرواتب						
13	النقص في كفاءة المراقبين						
14	الخطأ التحفيزية						
15	تأخر تسديد المالك للدفعات الى المقاول						
16	نقص في تدريب العمالة						
17	الخدمات المقدمة للعمال (تأمين على الحياة والرعاية الصحية...)						
18	عجز ادارة المقاول على عدم تنظيم متطلبات الموقع						
19	تكرار العمل						
20	تأخر الفحص						
21	الجدول الزمني غير عملي						
22	اكراميات (هدايا الاعياد, واجبات غذائية مجانيا, كتب مدرسية مجانيا للاولاد)						
23	تعديل التصميم للمشروع						
24	الافتقار الي الاجتماعات الدورية بالعمال						

رقم	العوامل المؤثرة على إنتاجية العمالة	درجة التأثير					ملاحظات
	عوامل خارجية	1	2	3	4	5	
25	سوء حالة الموقع						
26	وجود حوائث بالموقع						
27	حالة الطقس (رياح شديدة، جو حار، امطار و عواصف						
28	تغير الانظمة بواسطة الحكومة						
29	النقص في امدادات الطاقة والمياه						
30	مشاكل الوصول الي الموقع						
31	الكوارث الطبيعية (الفيضانات والاعاصير)						
32	اضاءة غير كافية						
33	الامان (السرقه و الجرائم)						
	عوامل تتعلق بالمواد	1	2	3	4	5	
34	تأخر وصول المواد الي الموقع						
35	نقص المعدات و الادوات						
36	عدم جودة المواد الخام						
37	زيادة اسعار المواد						
38	تضرر المواد داخل الموقع						
39	انتظار وصول المعدات						
40	نقص المواد						
41	عدم مطابقة المواد للمواصفات						

Appendix C Interview questions

Interview

Name:

Job Title:

Company

Years of Experience

- 1) Which are the main challenges that affect labour productivity within Egyptian Construction Projects?
- 2) How do Human/Labour factors, material factors, management factors, external factors affect labour productivity?
- 3) Considering the following 4 categories: Human/Labour factors, material factors, management factors and external factors would you change the ranking of the four categories? IF so why and how would ranking them?

Factor Group	Relative Importance Index (%) Average	Rank
Human/Labour Factors	77.73%	1
Material Factors	77.62%	2
Management Factors	73.65%	3
External Factors	73.10%	4

- 4) How the following major four factors can be eliminated significantly in order to improve labour productivity?
- 5) How key project stakeholders (client, contractor, subcontractor, suppliers, government) could improve labour productivity?